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A REVISION OF THE FISHES OF THE FAMILY SILLAGINIDAE

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ABSTRACT

Swimbladder morphology, cranial osteology and vertebral counts are shown to be of value taxonomically. The swimbladder is used to assess relationships between species and a systematic revision is proposed. The genera *Sillago*, *Sillaginopsis* and *Sillaginodes* are retained with three subgenera of *Sillago* (*Sillaginopodys*, *Parasillago* subgen. nov., and *Sillago*). Twenty-five species are described including seven new species and one new subspecies.

INTRODUCTION

The family Sillaginidae consists of three genera, three subgenera, twenty-five species and five subspecies of small to moderate sized fishes distributed in the shallow coastal waters of the Indian and western Pacific Oceans. The whitings or sand smelts form the basis of small but commercially important fisheries throughout their range.

The systematic position of the family has been conjectural. For Cuvier it was within the family Gobioides, but transferred later to the Percoides. Richardson (1846) erected a new family to accommodate it, but later placed it in the Uranoscopidae. Günther (1860) placed the genus *Sillago* into his family Trachinidae due to the number of vertebrae and long anal fin, but remarked that the structure of the skull is that of a Sciaenoid fish and in a footnote states 'The physiognomy of the fishes of this genus has a striking similarity to *Pachyurus*, a Sciaenoid genus'. Gill (1862a) reviewed the relationships of the family and although noting its resemblance to several families, concluded that 'its true relationship is rather difficult to be decided'. Gill observed however, that 'By its cavernous skull, it suggests the Sciaenoids and the *Acerinae* among the Percoids, but from both, it is at once separated by the long anal fin which is nearly equal to the dorsal, and by other morphological and anatomical characters, which the description of the family given above will at once suggest. Among the Percoids, it most resembles the species usually known under the name of *Acerina schraitzer*, but as will readily be learned on comparison, the resemblance is simply analogical. Among the Sciaenoids, the most analogous forms appear to be the genera *Pachypops* of Gill, and *Pachyurus* of Agassiz, or *Lepipterus* of Cuvier. The squamation of the fins, characteristic of the Sciaenoids, in addition to the shortness of the anal fin of those genera and the peculiarly dense squamation of the caudal fin of *Pachyurus*, evidently show that they are true Sciaenoids and exclude the entertainment of any strict or close affinity to the Sillaginoids. From the Trachinoids and the allied forms with which the family has been associated by Dr Günther, it is at once separated by the form and structure of the head'.

Gill also comments on Bleeker's earlier placement of the Sillaginidae with the family Sciaenidae where he subdivides the Sciaenoidei into the subfamilies Acerinaeformes (genera *Acerina* (= *Gymnocephalus*) and *Coptodon* (= *Tilapia*). Sillaginiformes (genera, *Sillago*, *Sillaginichthys* (= *Sillaginopsis*) and *Aspro* (= *Zingel*))) and Sciaeniformes. Gill then remarks 'The characters which distinguish the Sillaginoidae from the Sciaenoidae have been previously enumerated. The difference between them and *Aspro* are still more decided. As previously remarked, the resemblance to *Acerina* is much greater'.

Boulenger (1901) placed the family Sillaginidae close to the Sciaenidae and 'In the high number of vertebrae (12-14 + 14-20) they approach *Collichthys* (11 + 18) and *Lonchurus* (10 + 19)' and states 'The oblong and elongated cavernous head, with the praeopercle bent inwards below, covering a considerable part of the lower surface of the head, recalls *Aspro* among the Percidae, with which genus *Sillago* has been associated by Bleeker in 1859'.

The Sillaginidae differ from the Percidae in having three predorsal bones instead of one or none; no teeth on palatines; a spur on the posteriormost procurrent ray of the caudal fin; a variously developed subocular shelf, and a median pit containing two pores in addition to the pair of pores on the lower jaw. *Gymnocephalus*,

especially *G. acerinus* (Guldenstadt) is remarkably similar to the Sillaginidae in having two anal spines, the cavernous skull, the lower part of the preopercle bent inwards, 2 pores on the chin, one spine on opercle, the lateral line extending on to the caudal fin, dorsal fins united, 6–7 branchiostegal rays, vertebrae 33-38, and the swimbladder is present. The otolith of *G. acerina*, and to a lesser extent *Zingel zingel*, is remarkably like the Sillaginidae and from an 'otolithological point of view those of *Aspro* (= *Zingel*) only differ from sillaginids in a less strongly reduced dorsal field and a slightly deepened sulcus, which otherwise exhibits all characters typical for sillaginids. I have little doubt that *Aspro* (= *Zingel*) really is the closest relative to the sillaginids (W. Schwarzhans *pers. comm.* 17.1.1982)'. It appears that the family Sillaginidae is related to the Sciaenidae, Percidae, and to a lesser extent the Haemulidae, and exhibits many plesiomorphic characters. A study of their relationship with the above families is in progress.

This study commenced as a revision of the Western Australian species, but was expanded when it became obvious that a world-wide revision was necessary.

Because many species are very similar in external morphology a search was made for additional taxonomic characters that would permit the identification of species and local populations. The structure of the swimbladder, the cranial osteology, and the axial skeleton are of great value in the diagnosis of species.

The swimbladder was also of value in determining relationships in those species where this organ was present, and proved to be a most complex structure in many species. Most species have a duct-like process arising from the ventral surface of the swimbladder that extends to the urogenital opening. The 'duct' has not yet been fully investigated but it appears to be a tubular extension with a few blood capillaries that run posteriorly along the inner ventral surface of the swimbladder and then down the tube towards the urogenital opening where the duct appears to end blindly above and adjacent to the urogenital aperture; on the dorsal opening of the duct inside the swimbladder is an overlying valve-like process that almost blocks the entrance. Although sound production has been reported for the Sillaginidae, the complex nature of swimbladders with lateral and anterior projections, particularly those extensions that terminate on the basioccipital, and those with overlying modified vertebrae at the posterior tapering portion of the swimbladder, suggest that sound reception and perhaps amplification is involved. No sonic muscles are associated with the swimbladder and it is probably not used to produce sound.

The axial skeleton is highly modified in all species with a posterior tapering extension of the swimbladder. This peculiar modification was reported by Hotta (1961, p. 62) and Takahashi (1962, p. 24, fig. 117). The vertebrae overlying the swimbladder posteriorly from the first haemal arch have the parapophyses joined to form a bridge that partly surrounds the swimbladder, thus reinforcing the posterior tapering extension of that organ; such modified caudal vertebrae extend posteriorly to the termination of the swimbladder where the bifurcate tips fuse to form the more normal haemal spines. This modified section of the axial skeleton permits the separation of the vertebral column into three sections in most species of the genus *Sillago*. The tripartite separation of the vertebrae number is a most useful taxonomic character that has been extensively employed in delimiting species. Vertebral counts were found to be variable in most species examined but with surprisingly little overlap between species and no geographic clinal variation. Environmental factors may influence the number of vertebrae in teleosts (Barlow, 1961; Fowler, 1970), and in some species the vertebral number may show considerable variation whereas in others it may be species specific and characteristic of particular populations within a species. In the family Sillaginidae the vertebral number is a valuable aid to species and subspecies recognition in many cases, and may well prove to be of value in population analysis and in delimiting populations of widespread species.

The cranial osteology was examined for almost all species and its value as a taxonomic character is without doubt. The width and shape of the sensory canal bridges on the frontals, the shape of the subocular shelf on the third suborbital bone and the configuration of the otoliths are of particular value.

The caudal skeleton shows some differences between species and is being fully investigated. The complete osteology and relationships of the family Sillaginidae is now under study and will be presented in a forthcoming paper.

MATERIALS AND METHODS

This study is based on an examination of preserved specimens, fresh material and radiographs made available by many museums, scientific institutions, fisheries departments.

COUNTS

The dorsal and anal fin spines and rays were counted. The last dorsal and anal fin pterygiophore normally supports two rays counted as a single element. The anal spines were invariably two in number, the first anal spine may be reduced in size and requires careful dissection in some small specimens. In all type specimens the fin elements were counted from radiographs. The dorsal and anal rays were regarded in association and the fin ray counts are the number of specimens which had that particular fin ray formula.

Pectoral fin rays were normally 15–17 except *S. panijus* (20–22). The gillraker counts ranged from 1–5 + 1 + 6–12 and were of no value in separating species.

Lateral line scales bearing pores were counted from the upper margin of the operculum to the caudal flexure at the posterior margin of the hypural. When lateral line scales were missing it was sometimes possible to continue the count above the damaged region by using scale rows and then return to the pored scales beyond.

Transverse scale rows were counted from the origin of the dorsal fin in an oblique row to, but not including, the lateral line scales, and then from the origin of the anal fin obliquely forwards and upwards to the lateral line scales.

Number of cheek scale rows were counted from below the eye to the margin of the preopercle.

The vertebrae were counted whenever possible from boiled and defleshed unfixed specimens preserved by refrigeration, salting, or in some cases filleted specimens obtained from fish markets. Preserved specimens were cleaned and stained using a modified Hollister method (Hollister, 1934), or radiographed using industrial X-ray film. The axial skeleton was subdivided into three sections, the abdominal vertebrae from the base of the skull to the first haemal arch, the modified vertebrae overlying the swimbladder posteriorly (including the vertebrae bearing the first haemal arch which may be well developed, or almost of hair thickness and easily broken when dissecting specimens), and the caudal vertebrae bearing straight haemal spines. The conical terminal segment (urostylar vertebrae) is included.

MEASUREMENTS

These were made along the longitudinal axis of the body using a fish measuring board or a set square and a metre rule. Dial calipers were used to determine head, eye, snout and depth measurements. Twenty body dimensions were chosen at the commencement of the study but reduced to the following for species description:

Standard length (SL) was taken from the tip of the snout behind the upper lip to the caudal flexure at the hypural margin.

Head: from the tip of the snout to the posterior margin of the fleshy operele.

Snout: from tip of snout to anterior fleshy margin of eye.

Eye: the horizontal diameter between the fleshy margins of the orbit.

Interorbital width: the least width of the bony interorbital space.

Snout to first dorsal fin: from tip of snout to a line perpendicular to the origin of the spinous dorsal fin

Snout to second dorsal fin: from tip of snout to a line perpendicular from the origin of the spine preceding the rayed dorsal fin.

Snout to anal fin: from tip of snout to a line perpendicular to the origin of the first anal spine.

Greatest body depth: at middle of body.

Least depth of the caudal peduncle.

SWIMBLADDER

Specimens were dissected by a cut down the middle of the ventral surface from the isthmus to a few mm from the vent, thence circumventing anus and urogenital aperture along the side of the vertebral column to expose the full length of the swimbladder. The gills and viscera were removed and the thin peritoneum carefully pulled away from the surface of the intact swimbladder. Care should be taken not to damage any anterior or lateral appendages to the swimbladder nor break the duct-like process from the ventral surface of the organ to the urogenital aperture. The tubular 'duct' is quite firm in fixed specimens especially larger examples and is not connected to the alimentary canal (Fig. 1A).

ABBREVIATIONS OF INSTITUTIONS CITED

AMNH	American Museum of Natural History, New York.
ANSP	Academy of Natural Sciences, Philadelphia.
AM	Australian Museum, Sydney.
BM	British Museum (Natural History), London.
BPBM	Bernice P. Bishop Museum, Honolulu.
CAS	California Academy of Sciences, San Francisco.
CMFRI	Central Marine Fisheries Research Institute, Cochin.
CSIRO	CSIRO Division of Fisheries and Oceanography, Cronulla, N.S.W.

FRSK	Fisheries Research Station, Kanudi, Papua New Guinea.
HUJ	Hebrew University, Jerusalem, Israel.
MNHN	Museum National d'Histoire Naturelle, Paris.
NSMT	National Science Museum, Tokyo.
QM	Queensland Museum, Brisbane.
RUSI	Rhodes University, J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa.
SAM	South Australian Museum, Adelaide.
SOSC	Smithsonian Institution Oceanographic Sorting Centre.
SU	Stanford University, Division of Systematic Biology, California.
THUP	Biology Department, Tunghai University, Taichung, Taiwan.
UMMZ	Museum of Zoology, University of Michigan.
USNM	National Museum of Natural History, Division of Fishes, Washington.
USMK	Universitetets Zoologiske Museum, Copenhagen.
WAM	Western Australian Museum, Perth.
ZSIC	Zoological Survey of India, Calcutta.
ZUMT	Zoological Department, University Museum, University of Tokyo.

Family SILLAGINIDAE

Type genus: *Sillago* Cuvier, 1817.

The family Sillaginidae is represented by 3 genera, 3 subgenera, 25 species and 5 subspecies.

Body elongate, only slightly compressed, head tapering with terminal mouth; lower part of the preoperculum separated by a deep channel, directed horizontally, bent inwards to almost meet that of the other side. Body covered with small or moderate sized ctenoid scales, those of cheeks and opercles cycloid or ctenoid; lateral line scales simple.

Mouth with band of small villiform teeth; with an outer row of caninoids in one genus; maxillary concealed by large broadly triangular lachrimal bearing raised central dome-like arch that greatly increases the membranous infraorbital laterosensory canal; 5 suborbital bones present; third suborbital with subocular shelf of species-specific shape; operculum with small sharp spine; cranium elongate, somewhat pointed anteriorly; prevomer expanded anteriorly and laterally, flattened dorsally without a ridge, anterior lower surface with inverted V-shaped series of caninoid or villiform teeth.

Ethmoid a low flattened ridge anteriorly bearing poorly developed ethmoid processes in most species; frontals rise medially to a high keel, clasp ethmoid posteriorly and extend well back to form a high ridge that divides and forms a variously developed bridge on each frontal overlying the supraorbital laterosensory canal that continues anteriorly along the deeply grooved nasals to emerge as small oblique slits on the tip of the snout; supraoccipital arises between the flat parietals and continues in low profile posteriorly where it broadens; epiotics project posterolaterally, their lateral edges forming a ridge overlying deep groove between epiotics and pointed autopterotics. An open deeply grooved supratemporal-intertemporal canal formed above each autopterotic; emergence of temporal-supraorbital laterosensory canal through open groove laterally or enclosed circular foramin. Parasphenoid with a sharp ventral keel; anterior opening flares forward to receive posterior part of prevomer; posterior end widens and flattens above basioccipitals which are thin, and broadly expanded to house enlarged otolith; posterior part of myodome may open as narrow longitudinal slit or be completely closed. Osteocranium dominated by an extensive and highly developed sensory canal system; dermal roofing bones of cranium frequently elevated to accept laterosensory canal system; infraorbital laterosensory system highly developed and broadens at the lachrimal bone; preopercular system ventral and broadly developed to occupy most of ventral surface of head. The receptive areas anteriorly are enormously extensive and are characteristic of the family.

Two dorsal fins, first consisting of 10 to 13 slender spines, second of one slender spine and 16–27 rays; anal with 2 small slender spines and 14–26 rays; caudal emarginate; unpaired fins with membranes scaly, pectoral fin normal without scaly process at axil; ventral thoracic with 1 spine and 5 rays, modified in one species. Lateral line almost straight, continuing on caudal fin and with 50 to 141 pored scales to caudal flexure.

Swimbladder absent, poorly developed, or highly complex, with anterior and lateral extensions, and tapered posteriorly to form 1 or 2 slender extensions that project well into the caudal region. A unique duct-like process from the ventral surface of the swimbladder to the urogenital opening present or absent.

Vertebrae 32 to 44; caudal vertebrae modified where they meet the posterior extension of the swimbladder in many species.

Shore fishes of small to moderate size frequenting the Indo-Pacific region.

KEY TO GENERA OF SILLAGINIDAE

1. — Snout and head not depressed; second dorsal spine not elongate; eyes normal; swimbladder present 2
— Snout and head depressed; second dorsal spine elongate, eyes small and almost covered by fleshy orbit; swimbladder vestigial or absent ..... *Sillaginopsis* (p. 47)
2. — Lateral line scales 50 to 84 ... *Sillago* (p. 5)
— Lateral line scales 129 to 147 .... *Sillaginodes* (p. 46)

Genus **Sillago** Cuvier, 1817

Sillago Cuvier, 1817, type by subsequent designation, Gill, 1861, *Sillago sihama* (Forskal, 1775)

DIAGNOSIS

Sillaginidae in which the swimbladder is present, variously formed, simple or complex, with a duct-like process normally present on the ventral surface; lateral line scales 50 to 84. Dorsal spines 10 to 13, normally 11 or 12.

KEY TO SUBGENERA OF *SILLAGO*

1. — Ventral fin spine very small and situated at the base of a thickened club-shaped outer ventral ray; swimbladder reduced, no duct-like process; no modified caudal vertebrae ..... *Sillaginopodys*
— Ventral fin spine normal; swimbladder divided posteriorly into two tapering extensions; duct-like process present; modified caudal vertebrae present ..... *Sillago*.
— Ventral fin spine normal; swimbladder with the posterior extension single and tapering to a fine point, or rounded; duct-like process present; modified caudal vertebrae present or absent .... *Parasillago* subgen. nov.

Subgenus **Sillaginopodys** Fowler, 1933

Sillaginopodys Fowler, 1933, type by original designation *Sillago chondropus* Bleeker, 1849.

DIAGNOSIS

First ventral fin ray modified into a laterally compressed thickened club-like structure (Fig. 1B). Swimbladder reduced in size, no duct-like process from the ventral surface to the urogenital aperture. One species.

Sillago (Sillaginopodys) chondropus Bleeker

Club-foot Whiting
(Figs. 1B, 2A, 8B, 17)

Sillago chondropus Bleeker, 1849, p. 61 (Batavia), 1849, pp. 5, 8, 10; 1874, p. 65; 1877, pl. 389, fig. 2. Günther, 1860, p. 246. Gill, 1861, p. 504. Gilchrist and Thompson, 1908, p. 193; 1917, p. 248. Regan, 1908, p. 245. Barnard, 1927, p. 508. Weber and de Beaufort, 1931, p. 176, fig. 34. Fowler, 1933, pp 430–1; 1949, p. 96. Herre, 1939, p. 112, 1953, p. 478. Smith, 1949, p. 204, fig. 469. Palekar and Bal, 1955, p. 128. Munro, 1958, p. 178; 1967, p. 346 Dutt and Sujatha, 1980, p. 372. McKay, 1980, pp. 382–3.

MATERIAL EXAMINED

TYPE: The location of the holotype is unknown.

OTHER MATERIAL South Africa (2); SOSC 480, RUSI 469, Durban Pakistan (8), SOSC 23, Field No. LW-1, 177 miles west of Karachi at west end of Astola Island, India (3); ZSIC 6068/2, Calva Beach, Goa; SOSC 381, Thirumillivasal, Madras State; AM B8095, Madras. New Guinea (3); CSIRO C790, Minga Creek, Wewak; CSIRO C780, Likei River, Manus Island, FRSK FO 1405 Ramu River. QM 112914, Chantaburi, Gulf of Thailand. Philippines (6); USNM 145340 (3) Abuyog, Leyte; USNM 145095, Lingayan Gulf, Luzon; USNM 145341, Daet, Luzon; USNM 145115, Camiguin Island, Babuyan Islands.

DIAGNOSIS

First ventral ray modified into a laterally compressed club-like structure which overlaps a much reduced ventral spine at the base of the fin.

DESCRIPTION

Dorsal fins XI-XII, 1, 20–22; anal fin II, 22–23 (Table 1). Lateral line scales 66–73 (Table 2); TR 6 above, 9–10 below. Cheek scales in 3–4 rows, all ctenoid.

Proportional dimensions as percent of SL: greatest depth of body 15–16; head length 25; snout tip to ventral fin origin 26–27; snout tip to spinous dorsal fin origin 28–29; snout tip to second dorsal fin origin 50–51; snout tip to anal origin 47–50; least depth of caudal peduncle 7.9–8.4.

Proportional dimensions as percent of head: length of snout 32–35, horizontal diameter of eye 19–22; least width of interorbital 14–17.

VERTEBRAE: 12–13 abdominal, 22–23 caudal, total 35 (see Table 3).

COLOUR IN ALCOHOL. Pale sandy brown, above, paler below, scale margins dusky; a dull silver-grey mid-lateral band usually present, frequently with a wide dusky band below on lower sides. Fins hyaline, the spinous dorsal tinged brown with a fine dusting of black spots at the tip.

SWIMBLADDER: (QM 112914) commences as a very flattened presumably non functional structure just behind the axis vertebrae and then rather abruptly narrows to a fine point terminating on the ninth abdominal vertebra (Fig. 8B). No duct-like process from the ventral surface is present, as the posterior extension terminates well before the first haemal arch. Modified caudal vertebrae are not present.

Palekar and Bal (1955, p. 128) examined 12 specimens from near Karwar and stated that the swimbladder was absent.

DISTRIBUTION

South Africa, Mozambique, West Pakistan, India, Burma, Indonesia, New Guinea, Thailand and Philippines (Fig. 17). Not recorded from southern New Guinea or Australia.

REMARKS

A number of authors (Günther (1860), Gill (1861), Fowler (1933), Palekar and Bal (1955, etc.)) have described the ventral fin spine as thickened and united with the first ray. Weber and de Beaufort (1931) state that this spine is normal, not thickened, but very slender and consolidated with the much thickened first ray, both forming a single body. Smith (1949) describes the spine as short and adnate to the thickened recurved first ray.

Figure 1B shows the ventral spine to be short and situated below the thickened recurved pad of the first ventral ray; the second ventral ray is unmodified. The reduced swimbladder and modified ventral fin indicates that this species is demersal and may use the ventral fin pads somewhat like sled runners on the bottom.

Palekar and Bal (1955, p. 128) found that in 12 specimens the first haemal arch invariably occurred on the thirteenth vertebra. Additional vertebrae counts taken throughout the range of this species may show some local populations to exist as I find 12 to 13 abdominal vertebrae.

TABLE 1: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO CHONDROPUS*

Dorsal rays	20	21	21	22
Anal rays	23	22	23	23
South Africa	1	–	1	–
Pakistan	1	–	4	2
India	–	–	2	1
New Guinea	–	–	1	2
Thailand	–	1	–	–
Philippines	2	–	4	3

TABLE 2: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO CHONDROPUS*

Lateral line scales	66–67	68–69	70–71	72–73
South Africa	–	1	1	–
Pakistan	1	3	2	–
India	–	–	2	1
New Guinea	–	2	1	–
Thailand	–	–	1	–
Philippines	–	2	4	2

TABLE 3: VERTEBRAE COUNTS OF *SILLAGO CHONDROPUS*

Abdominal	12	13
Caudal	23	22
South Africa	–	1
Pakistan	2	–
India	1	1
New Guinea	–	2
Thailand	1	–
Philippines	–	4

Subgenus **Sillago** Cuvier, 1817

Sillago Cuvier, 1817, type by subsequent designation, Gill, 1861, *Sillago sihama* (Forskal).

DIAGNOSIS

Swimbladder present and divided into two tapering extensions posteriorly. *Sillago megacephalus* is poorly known and is tentatively included in this subgenus.

KEY TO SPECIES OF THE SUBGENUS *SILLAGO*

1. — Dorsal spines 12–13; 79–84 lateral line scales; 38–39 vertebrae . *Sillago parvisquamis*
   — Dorsal spines 11; 66–72 lateral line scales; 33 vertebrae 2
2. — Body with a longitudinal row of dark spots below the lateral line and a series of dark saddle-like blotches on back ..... *Sillago intermedius*
   — Body uniform in colouration 3
3. —Head length 24–30 percent of standard length; vertebrae 33 ..... *Sillago sihama*
   — Head length 33 percent of standard length; vertebrae unknown ...? *Sillago megacephalus*

Sillago (Sillago) sihama (Forskal)

Northern Whiting or Sand Smelt
(Figs. 2B, 6AB, 14A, 15)

Atherina sihama Forskal, 1775, p. 70 (Lohaja, Red Sea). Bonnaterre, 1788, p. 178. Gmelin, 1789, p. 1396. Lacepede, 1803, pp. 371, 373.

Platycephalus sihamus: Bloch and Schneider, 1801, p. 60.

Sciaena malabarica Bloch and Schneider, 1801, p. 81, pl. 19 (Tranquebar).

Sillago acuta Cuvier, 1817, p. 258 (Sea of the Indies). Bleeker, 1849, pp. 4, 5, 8, 10, 11, 14, 69; 1853, p. 4; 1859, p. 158. Günther, 1864, p. 308. Kner, 1865, p. 128. Jouan, 1868, p. 252.

Sillago sihama: Ruppell, 1825, p. 9, pl. 3, fig. 1. Günther, 1860, p. 243; 1861, p. 221; 1880, p. 56. Gill, 1861, p. 504. Bleeker, 1864, p. 56; 1865, p. 56; 1874, p. 67; 1876, p. 332; 1878, p. 46. Day, 1865a, p. 18; 1865b, pp. 47–8; 1868, p. 299; 1870, p. 686; 1878, p. 265, pl. 57, fig. 3; 1879, p. 35. Schmeltz, 1866, p. 8; 1969, p. 16; 1879, p. 44. Playfair, 1867, p. 861. Klunzinger, 1870, p. 818; 1879, p. 369; 1884, p. 123. Peters, 1877, p. 836. Macleay, 1883, p. 360. Steindachner, 1893, p. 237. Elera, 1895, p. 500. Rutter, 1897, p. 87. Jordan and Snyder, 1901, p. 109; 1902, pp. 486–7. Jordan and Evermann, 1902, p. 360. Johnstone, 1903, p. 295. Fowler, 1904, p. 549; 1925, p. 248; 1927, p. 286; 1928a, p. 235; 1928b, p. 709; 1930, pp. 611, 654; 1931a, p. 337; 1931b, p. 302; 1931c, p. 337; 1933, pp. 417–21; 1934a, p. 422; 1934b, p. 474; 1935, p. 150; 1937, p. 238; 1939, p. 50; 1949, p. 50. Pellegrin, 1905, p. 83; 1907, p. 203; 1914, p. 225. Jordan and Seale, 1905a, p. 782; 1905b, p. 12; 1907a, p. 12; 1907b, p. 25. Jordan and Starks, 1905, p. 205; 1917, p. 455. Gilchrist and Thompson, 1908, p. 192; 1916, p. 275; 1917, p. 348. Regan, 1908, p. 245. Jordan and Richardson, 1909, p. 192. Jenkins, 1910, pp. 132, 136. Seale, 1910, p. 281; 1914, p. 69. Weber, 1913, p. 267. De Beaufort, 1913. p. 119. Jordan, Tanaka and Snyder, 1913, p. 187. Jordan and Metz, 1913, p. 41. Jordan and Thompson, 1914, p. 259. Maxwell, 1921. p. 33. Fowler and Bean, 1922, p. 68; 1927, p. 8. Chaudhuri, 1923, p. 721. Hora, 1924, p. 489. Vinciguerra, 1926, p. 583. (?) Paradice and Whitley, 1927, p. 89. Barnard, 1927, pp. 507–8. Reeves, 1927, p. 10. Whitley, 1928, p. 12; 1964, p. 43. Mori, 1928, p. 6. Gudger, 1929, p. 528. Duncker and Mohr, 1929, p. 70. Weber and de Beaufort, 1931, pp. 172–3. Borodin, 1932. p. 85. Herre, 1933, p. 4; 1939, p. 112; 1953, pp. 479–80. Martin and Montalban, 1934, pp. 222–4. Umali, 1934, p. 371. Hardenberg, 1936, p. 246; 1941, p. 227. Villadolid, 1937, p. 192. Blanco, 1938, p. 507. Domantay, 1940, p. 98. Gopinath, 1942, p. 337; 1946, pp. 13, 19. Chako, 1949a, p. 33; 1949b, p. 95; 1950, p. 171. Smith, 1949, p. 203, fig. 467; 1955, p. 44. Suvatti, 1950, p. 395. Tripathy, 1952, pp. 80, 84. Radhakrishnan, 1954, p. 196; 1957, pp. 254–83. Palekar and Bal, 1955, p. 128; 1961, pp. 76–93. Munro, 1955, p. 121; 1958, p. 178; 1967, p. 347. Tomiyama and Abe, 1958, p. 1176. Scott, 1959, p. 56. Menon, 1961, p. 387. Khalaf, 1961, p. 80. Smith and Bailey, 1961, p. 359. Misra, 1962, pp. 232–3. Nadkarni, 1963, pp. 164, 166. Smith and Smith, 1963, p. 18. Marshall, 1964, p. 170. Grant, 1965, p. 88; 1972, p. 243. Alfred, 1966, p. 100. Arnoult and Fourmanior, 1967, p. 137. Macnae and Kalk, 1969, p. 132. Krishnamurty, 1969, pp. 295–303. Ramamurthy and Dhulkhed, 1977, pp. 283–4. James, Verghese and Devaraj, 1978, pp. 212–20. Shao and Chang, 1978, p. 9, pl. 1, fig. 3, pl. 2, fig. 3; 1979, pp. 695–705. Dutt and Sujatha, 1980, pp. 371–75. McKay, 1980, pp. 381–2, fig. 1D.

Sillago erythraea Cuvier, 1829, p. 409 (Suez, Red Sea).

Sillago malabarica Cantor, 1849, p. 1003. Bleeker, 1853, p. 34; 1859, p. 2. Gill, 1862, p. 504. Pohl, 1884, p. 32.

Silago ihama (misprint), Fowler, 1928b, p. 16.

MATERIAL EXAMINED

TYPES: *Atherina sihama* Forskal. Holotype registered No. 71 in the Zoological Museum of Copenhagen. Klausewitz and Nielsen (1965, p. 27, pl. 38, No. 71, photograph and radiograph) have recorded 18 anal rays, but a re-examination (Nielsen, *pers. comm.* 25.xi.1966) shows a few additional detached dorsal rays, the cycloid cheek scales. No vertebrae count is possible as the holotype consists of a dried skin with the skull *in situ*. The suborbital bones could not be examined.

Sciaena malabarica Bloch and Schneider. Type not examined.

Sillago acuta Cuvier. Radiographs of four syntypes in the Museum National D'Histoire Naturelle, Paris, were kindly forwarded by Dr M. Blanc. Three paralectotypes registered A.3118 from Batavia have vertebrae counts of 14–5–15 (2), and 14–6–14 (1). The specimen registered A.5270, collected by Dussumier, Coromandel, India, SL.177 mm is here designated lectotype. Two dried paralectotypes registered A.5427, from Pondicherry, with the vertebral column removed, were not radiographed.

Sillago erythraea Cuvier. Two syntypes in the Museum National D'Histoire Naturelle, Paris. Radiographs forwarded by Dr M. Blanc. One specimen registered A.3137, collected by Mr Ehrenberg at Mer Rouge (Red Sea) has a vertebrae count of 14–3–17 and is here designated lectotype. A.3127, a paralectotype from Suez has a vertebrae count of 14–3–17.

OTHER MATERIAL: South Africa (8); RUSI 7487, East London; RUSI 7179, Isipingo; WAM P19237–43, Durban. Mozambique (45); SOSC 476 (10), Mozambique; SOSC 476 (17), Delagoa Bay; SOSC 476 (8), Lourenco Marques; SOSC 476 (2) Ponta Maboul; USNM 72868 (6), Changane; SOSC 170, near Zambezie River. Zanzibar, WAM P0177; WAM P15353. Malagasy (42); SOSC 54, Ampora Village; SOSC 54 (9), Baie d'Amboro; SOSC 54 (29), Nossi Be; SOSC 134, Nossi Be; USNM 171079, Anjouan; SOSC 145, Mayotte Island, Comores. Kenya (8); AMNH 19619, Kenya; RUSI 467, M883, Malindi; SOSC 145 (5), Duruma River. Seychelles (4); USNM 12634 (2), Seychelles; SOSC 145, Mahe Island; RUSI 467, Sey. 132, South Mahe. Somali, AMNH 8175 (3). Ethiopia, USNM 49324, Massawa. HUJ F7134, Abu Zenima, Gulf of Suez, Red Sea. Muscat, BM 87 ii.ii.226. Persian Gulf, USNM 147959 (2). Pakistan (29); SOSC 23 (19), 177 miles west of Karachi; WAM P15559–68 (10), Karachi.

P13223, Gulf of Carpentaria; QM I12970, Mackay; QM I13220, Repulse Bay, Proserpine; AM IA2326, AM IB3582, QM I4564, Townsville, New Caledonia (8); WAM P15662–9, Noumea, Santa Cruz Island, AM IA2853, Vanikoro Island, SOSC 252 (32), Thailand (214); QM I13219 (31) Chantaburi; SOSC 4 (58), Patong Bay, Phuket, Indian Ocean; SOSC 56 (32), Koh Sindarar Nua, Indian Ocean; CAS-GVF 2207, Pakchan River, Indian Ocean; CAS 14191, CAS-GVF 1511, CAS 14179 (4), Songkhla Channel; Chumphon Province, CAS 13422 (2), CAS-GVF 2639 (3), Lem Saplee, CAS 14193 (4); Ban Thup Tanhot, CAS 14186 (2) Lansuan District, CAS-GVF 2187, CAS-GVF 2197 (2), CAS-GVF 2201, Ko Matapoan, CAS-GVF 2194 Kua Larn; CAS 14178, CAS-GVF 2655 (10), Prachuap, Khiri Khan India (122); SOSC 334 (4) Cochin, Kerala State; USNM 149705 (5) Kalimeen, Travancore; SOSC 334 (4) Pondicherry, Madras State; WAM P15715–8, Mylapore; SOSC381 (83), Porto Novo; SOSC 334 (2), Porto Novo; SOSC 334 (3); Ennore; SOSC 334 (8), Mandapam Camp; SOSC 334, Royapuram Beach; SOSC 334, Thirumulli Vasal Village; SOSC 334 (4), Pulicat Lake, AM B8212 (2) Madras. USNM 32695, India. Sri Lanka SOSC T170–304, SOSC T170–316 (16), SOSC 7–317 (6), Colombo; SOSC CCK69-33 (2), Payagala. Malaysia (23); WAM P14553–72, WAM P14864, AM B5046 (2), Penang. Singapore, USNM 83490. Indonesia (54); AMNH 1563, AMNH 17534 (2), AMNH 19798–9, USNM 72692, Batavia (Djakarta); USNM 88009–10 (43), Benkoelen, Sumatra; North Borneo (Sabah) (5), USNM 145121. New Guinea (55); CSIRO A13 Pulie River, CSIRO C131 Ring Ring, New Britain; FRSK F01458 (4), Kerevat, New Britain; CSIRO C1780, Lihei River, Manus Island; CSIRO C1668, Vilirupa; CSIRO C1525, Sinapa; CSIRO C914, Kapa Kapa; CSIRO C1030, Oro Bay; FRSK F01054 (4), Yule Island;FRSK (2) Hall Sound; FRSK F01491 Talasia, New Britain; FRSK F01425, New Britain; FRSK (7) Orangerie Bay; FRSK (2), Sepik River; FRSK F01707 (2), Ramu River; FRSK F0625, South of Ramu River; FRSK F0388 (3), Darapap, Madang; AMNH 14013, Daru Island; QM I13218 (11) Daru Island; AM A12801, New Guinea; UNSM 30583 (2), New Guinea. Western Australia (25); CSIRO C2362, Dampier Archipelago; WAM P0654–73, Nichol Bay; WAM P13990–2; Broome; CSIRO A1300, AM IB3088, Trubridge Creek, Northern Territory (132); AM IA 1537, AM I15289, Darwin; USNM 174066, 7 miles north of Darwin; QM I13156 (50) Twin Eagles Beach, Gove; QM I13155 (2), QM I13161 (3), QM I13169 (4), QM I13160 (2), QM I13165 (4), QM I13159 (20), QM I13163 (6), QM I13167 (6), I13158 (12), Gove area; USNM 174065 (18), Port Bradshaw; CSIRO A2646, A2555, Northern Territory. Queensland (11); QM I15176, QM I11108, Cairns, QM 16130–1, Cape Cleveland; CSIRO A1943, Embley River, Weipa; WAM Province; CAS 14181, Mae Nam Prasae River; CAS 14192 (3), Mae Nam Mae Klong River; CAS-GVF 1595, Mae Man Welu River at Ban Klong Sone Village; CAS 14177 (9), Aoa Klong Sone Bay, north end of Ko Chang Island; CAS 14170 (3), Ko Dram Noi Island near Ko Kram Yai Island; CAS-GVF 1461 (2), Ko Dram Island; CAS-GVF 1541 (3), Chol Buri; CAS 14174 (3), Chol Buri Bay; CAS 14184, Ko Lan Island; CAS 14172, Rayong Bay, Sattahip Bay; CAS 14190, CAS 14189 (3), CAS-GVF 2174 (2), Ban Pae, Rayong Province; CAS 4185 (5), Ko Saked Island; CAS-GVF 2124 (2) Rayong Province; CAS-GVF 1470 (2), Ko Samet Island; CAS 14187 (5), The Chalaep Harbour, Chantaburi Province; CAS-GVF 14188 (10), Ko Mak Island near Trat Bay; CAS 14188 (2), Lam Son Village, south of Trat Bay. South Vietnam (6); WAM P19226–8, WAM P0600, WAM P0974–5, Vung Tau. China (7); USNM 87031, USNM 86368 (3), Foochow, Fukien; BM 55.12.25.501, Canton; BM 60.7.20.37 (2), Chioa, Hong Kong (10); WAM P15549–57, USNM 145122. Korea, USNM 51508. Taiwan (7); THUP 00344 (4) (WAM coll.) Tungkong; WAM P0473–4, Tungkong; USNM 208325, Taipei Market; BM, No No. Taiwan. Philippines (161); Mindanao, USNM 145120 Panabutam, USNM 145112, USNM 150642 (2), Davao, USNM 145105 Parang Parang, USNM 145101 Catabato; Palawan, USNM 145090 (7) Verde del Sur, USNM 150858 (14), USNM 122903 (2), USNM 145107 Mantaguin Bay USNM 145113, Endeavour Strait, USNM 145104 Malampaya; Negros, CAS 14175 (3) Negros Island, USNM 51989 south Negros; Cebu, USNM 84181; Leyte, USNM 150655 Hinunangan Beach, USNM 145109 (3) Hinunangan Bay; UNSM 145100 Abuyog, USNM 145091 (6) Malaga River; USNM 145087 (5) Guimaras Island; Panay, USNM 102475, USNM 106803, USNM 145102, USNM 145103, USNM 106863, USNM 106865 (2), USNM 106866, USNM 102672, USNM 102547, USNM 102696 (2), USNM 106867, Iloilo; Mindoro, USNM 145119 (7) Sablayan Bay, USNM 145108 Paluan Bay; Samar, USNM 145092 (3) Catbalogan; Luzon, CAS 14173 (2) Batangas Bay, USNM 145084 (8) Ragay River, USNM 145097 Matnog Bay, USNM 145114 Dagupan, USNM 145094 Balayan Bay, USNM 145110 Dumaca River, USNM 145111 Lagonog Gulf, USNM 145118 Subig Bay, USNM 145096 (2) Yava River, USNM 145106 San Fernando, USNM 145086 (13) St. Vincente Harbour, USNM 145088 (6) Daet Point, USNM 145098 Caringo Island, USNM 145099 (2), USNM 56296 (3) Cavite, USNM 145089 (5), USNM 83082, USNM 145083 (9), USNM 150656 (2), USNM 145085 (4), CAS 14183 (3), WAM P21612–19, AMNH 3917, Manila, USNM 72276 (2) Aparri; Lugang, USNM 145093 (2) Tilig; AMNH 13928 (2) Philippines.

DIAGNOSIS

Dorsal fins XI, 1, 20–23; anal fin II, 21–23, lateral line scales 66–72; total vertebrae 34. Morphologically similar to *Sillago japonica* and *Sillago lutea* but differs in having two posterior extensions to the swimbladder, wider frontal arches on the skull, and in the vertebrae counts which are 33–35 in *S. lutea*, 35 in *S. japonica* and 34 in this species. From *S. megacephalus* this species differs in the relatively smaller head (24–30% instead of 33% in *S. megacephalus*).

Description

Dorsal fins XI, 1, 20–23, anal fin II, 21–23 (Table 4). Lateral line scales 66–72 (Table 5). TR. 5–6 above, 10–12 below, 4–5 (usually 5) scales between lateral line and spinous dorsal fin origin. Cheek scales in 2 (rarely 3) rows, all cycloid.

Proportional dimensions as percent of SL: Greatest depth of body 16–20; head length 24–30; snout tip to ventral fin origin 28–32; snout tip to spinous dorsal fin origin 32–35; snout tip to second dorsal fin origin 54–57; snout tip to anal fin origin 54–58; least depth of caudal peduncle 7–8.

Proportional dimensions as percent of head: Length of snout 35–42; horizontal diameter of eye 21–26; least width of interorbital 16–21.

VERTEBRAE: 14 abdominal, 2–8 modified, 12–18 caudal; 14+20, total 34 (see Table 6). Juvenile specimens from the Northern Territory have 13 abdominal vertebrae and a very fine almost hair-like first haemal arch. Adult specimens have the normal 14 abdominal vertebrae.

COLOUR IN ALCOHOL: Body light tan, silvery yellow-brown, sandy-brown, or honey coloured; paler brown to silvery white below; a mid-lateral, silvery, longitudinal band normally present; dorsal fins dusky terminally with or without rows of dark brown spots on the second dorsal fin membrane; caudal fin dusky terminally; no dark blotch at the base of the pectoral fin; other fins hyaline, the anal fin frequently with a whitish margin. After long preservation the colouration may become a uniform light brown.

SWIMBLADDER: Two anterior extensions extend forward and diverge to terminate on each side of the basioccipital above the auditory capsule; two lateral extensions commence anteriorly, each sending a blind tubule anterolaterally and then extending along the abdominal wall below the investing peritoneum to just posterior of the duct-like process; two posterior tapering extensions of the swimbladder project into the caudal region, one usually longer than the other. The lateral extensions are normally convoluted and have blind tubules arising along their length (Figs. 6AB) but in smaller examples may be more or less convoluted with fewer or no blind tubules. Some variation has been observed in the shape of the lateral extensions, but all specimens examined have the lateral extensions convoluted to some extent. The swimbladder of *Sillago sihama* is similar to that of *Sillago parvisquamis* but the lateral extensions are always much more simple than the latter species. Specimens from northern Australia have relatively longer posterior extensions than specimens from the Red Sea or New Caledonia, and have a greater number of modified caudal vertebrae.

Geographic Variation

The vertebrae counts show some geographic variation (Table 6); specimens from the northern coast of New Guinea have two or three modified caudal vertebrae whereas from the southern coast and northern Australia four to eight modified vertebrae are usual. A large series of specimens from both areas should be examined.

Distribution

A wide ranging species throughout the Indo-West Pacific region. Although *Sillago sihama* has been recorded from Japan by numerous authors (see *S. japonica*) it appears that all such records refer to *Sillago japonica*. The two species can be positively identified by reference to the swimbladder morphology, and the total vertebrae counts (33 in *S. sihama,* 34 in *S. japonica,* see also Tables 6 and 45).

Biology

Sillago sihama is a nearshore species that frequently penetrates estuaries for considerable distances. The species has been recorded from freshwater by Günther (1861, p. 221) and Macleay (1883, p. 360), despite the absence of renal corpuscles or tubules in the kidney (Nadkarni, 1963). In northern Australia *S. sihama* is common along the beaches, sandbars, mangrove creeks and estuaries; it is very rarely captured by prawn trawling vessels.

Large schools may be found in shallow water where they are captured by seine-net. Important commercial fisheries have been developed on *S. sihama* in Pakistan, India and the Philippines, and throughout the range of the species it is an important food fish of delicate flavour. The maximum size attained is approximately 25 to 31 cm (Radhakrishnan, 1954; Fowler, 1935; Chacko, 1949), but larger specimens may occur as Day (1865) mentions specimens that were reported as being 3 feet in length (*Albula*?)

The biology of *S. sihama* has been reported by a number of authors, principally Gopinath, 1946 (fishery), Chacko, 1949a, 1949b (food and feeding), 1950 (spawning, eggs, larvae), Tripathy, 1952 (parasites), Radhakrishnan, 1954 (growth), Palekar and Bal, 1955 (fishery), 1961 (maturation and spawning).

Like most members of the family, *S. sihama* may bury itself in the sand when danger

approaches (Maxwell, 1921) and commonly avoids seine-nets by employing this behaviour.

REMARKS

Sillago sihama is commonly confused with a number of uniform coloured whiting species. All identifications must involve an examination of the swimbladder after careful removal of the dark brown or black peritoneum in addition to lateral line scale and fin ray counts; this was not always possible with the material examined above as many specimens were forwarded to me on loan, therefore radiographs were taken and the shape of the suborbital shelf was checked whenever possible (see Fig. 14A). Large samples had one or two specimens carefully dissected and fresh material was obtained when available.

Sillago (Sillago) intermedius Wongratana

Thai Whiting
(Figs. 2C, 8A)

Sillago intermedius Wongratana, 1977, pp. 257–262. (East coast, Gulf of Thailand).

Sillago maculata: Dutt & Sujatha, 1980, pp. 372–4 (non *Sillago maculata* Quoy and Gaimard).

MATERIAL EXAMINED

PARATYPES: QM 113606, BMNH 1976-11-17-1, BMNH 1976-11-17-2.

OTHER MATERIAL: QM 113795, east coast Gulf of Thailand via Bangkok Fish Market, 1975, T. Wongratana, S.L. 100 mm. (4) Visakhapatnam, India, March 4, 1982, K. Sujatha, S.L. 70–79 mm.

DIAGNOSIS

Two posterior extensions to the swimbladder; anterior margin with two divergent blind tubes that extend to the basioccipital above the auditory capsule; an anterolateral extension on each side, each sending a blind tubule anteriorly and then curving posteriorly along the abdominal wall as a simple tube to terminate just posterior to the duct-like process. Sides of body just below lateral line with a longitudinal row of dusky black spots, and a series of saddle-like dusky black blotches.

DESCRIPTION

Dorsal fins XI, I, 21–22; anal fin II, 21–22. Lateral line scales 67–70. TR. 6–7 above, 8–9 below, 6–7 scales between lateral line and spinous dorsal fin origin. Cheek scales in 2 rows, all cycloid.

TABLE 4: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO SIHAMA*

Dorsal rays	20	20	21	21	21	22	22	23
Anal rays	21	22	21	22	23	22	23	23
South Africa	2	3	–	2	1	1	–	–
Mozambique	2	2	–	17	3	7	–	–
Zanzibar	–	–	–	2	–	–	–	–
Malagasy	1	3	–	10	–	–	–	–
Kenya	2	1	–	3	2	–	–	–
Seychelles	–	–	1	2	–	–	–	–
Somali	–	–	–	2	1	–	–	–
Pakistan	–	–	–	–	3	1	6	–
India (West Coast)	–	–	1	6	–	2	2	–
India (East Coast)	–	1	–	19	6	3	19	2
Sri Lanka	2	1	1	19	1	–	1	–
Malaysia	–	5	–	11	4	–	–	–
Indonesia	2	4	4	10	1	1	–	–
Sabah	–	–	–	4	–	–	–	–
New Guinea (North Coast)	1	3	3	5	2	–	–	–
New Guinea (South Coast)	–	3	1	20	5	1	–	–
Western Australia	1	1	–	1	–	–	2	–
Northern Territory	–	–	–	61	5	–	1	–
Queensland	–	–	–	10	–	–	1	–
New Caledonia	–	–	1	4	–	3	–	–
Santa Cruz Is.	–	–	–	3	–	–	–	–
Thailand	5	6	4	70	6	7	–	–
South Vietnam	–	–	3	3	–	–	–	–
China	–	1	–	5	–	1	–	–
Hong Kong	3	–	–	–	1	1	1	–
Taiwan	–	4	–	2	–	1	–	–
Philippines	28	30	17	111	22	5	8	–

TABLE 5: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO SIHAMA*

Lateral line scales	66	67	68	69	70	71	72
Mozambique	–	2	14	12	5	1	–
Zanzibar	–	1	–	1	–	–	–
Malagasy	–	2	4	6	–	–	–
Kenya	–	3	2	–	–	–	–
Seychelles	–	–	2	–	–	–	–
Pakistan	–	–	4	5	2	–	–
India (West Coast)	–	1	–	4	3	2	–
India (East Coast)	–	1	10	8	7	12	5
Ceylon	–	5	8	11	1	–	–
Malaysia	–	1	5	7	3	4	–
Indonesia	–	1	2	2	1	–	–
North Borneo	–	2	3	–	1	–	–
New Guinea (North Coast)	–	2	2	8	–	–	–
New Guinea (South Coast)	–	4	8	11	1	2	1
Western Australia	–	–	2	1	–	–	–
Northern Territory	2	7	1	13	13	1	1
Queensland	–	2	6	1	1	1	–
New Caledonia	–	1	3	3	1	–	–
Santa Cruz Is.	–	–	1	3	–	–	–
Thailand	1	5	32	38	16	1	–
South Vietnam	–	1	3	1	–	–	–
China	–	–	2	–	–	–	–
Hong Kong	–	1	6	3	–	–	–
Taiwan	–	3	4	2	2	–	–
Philippines	11	19	28	33	3	1	–

TABLE 6: VERTEBRAE COUNTS OF *SILLAGO SIHAMA*

Abdominal	14	14	14	14	14	14	14
Modified	2	3	4	5	6	7	8
Caudal	18	17	16	15	14	13	12
South Africa	–	1	3	1	–	–	–
Mozambique	–	–	3	3	2	–	–
Zanzibar	–	–	1	–	–	–	–
Malagasy	–	–	1	1	–	–	–
Kenya	–	–	1	–	1	–	–
Seychelles	–	1	–	–	–	–	–
Somali	–	–	–	3	–	–	–
Red Sea	–	2	–	1	–	–	–
Pakistan	–	–	–	2	2	–	–
India (West Coast)	–	3	–	2	–	–	–
India (East Coast)	–	–	1	2	1	1	–
Ceylon	–	–	–	1	–	–	–
Malaysia	–	–	2	2	–	–	–
Indonesia	–	–	2	2	1	–	–
North Borneo	–	–	–	–	–	1	–
New Guinea (North Coast)	3	13	–	–	–	–	–
New Guinea (South Coast)	–	–	2	10	12	7	3
Western Australia	–	–	–	6	16	2	–
Northern Territory	–	–	–	1	2	–	–
Queensland	–	–	2	5	1	–	–
New Caledonia	–	5	–	–	–	–	–
Santa Cruz Is.	–	–	1	–	–	–	–
Thailand (Pacific Ocean)	–	1	21	20	2	–	–
Thailand (Indian Ocean)	1	8	6	–	–	–	–
South Vietnam	–	–	–	3	2	–	–
Hong Kong	–	–	2	1	–	–	–
Taiwan	–	–	1	2	–	–	–
Philippines	–	–	8	7	2	–	–

Proportional dimensions as percent of SL: Greatest depth of body 16–19; head length 30–31; snout tip to ventral fin origin 31–33; snout tip of spinous dorsal fin origin 36–37; snout tip to second dorsal fin origin 56; snout tip to anal fin origin 58–60; least depth of caudal peduncle 7.

Proportional dimensions as percent of head: length of snout 37–40, horizontal diameter of eye 22–26; least width of interorbital 18.

VERTEBRAE: 14 abdominal, 5 modified, 15 caudal; 14 + 20, total 34.

COLOUR IN LIFE: Pale silvery, darker on back; top of snout black to blackish; opercle, preopercle, preorbital around nostrils and base of pectoral bright silver; supracleithral region with a short black almost vertical streak; sides of body just below lateral line with a longitudinal row of 8 to 9 dark spots or blotches, the first present or absent on the opercle, the next 2 or 3 below the spinous dorsal fin, the following 4 or 5 below second dorsal fin and one on caudal peduncle; back with a series of saddle-like dusky blotches, the first 2 on nape, 2nd and 3rd below spinous dorsal fin, 5th to 9th blotches below second dorsal fin and one on the upper lobe of the caudal fin; a silvery lateral band present or absent, spinous dorsal fin greyish, second dorsal fin translucent with a series of 2 to 4 darker spots on membranes and a black spot at the base of each dorsal ray; caudal greyish with the upper and lower rays darker; other fins hyaline.

SWIMBLADDER: Two anterior extensions extend forward and diverge to terminate on each side of the basioccipital above the auditory capsule; two lateral extensions commence anteriorly, each sending a blind tubule anteriorly and then extending along the abdominal wall adjacent to the swimbladder below the investing peritoneum to just posterior to the duct-like process; two posterior tapering extensions of the swimbladder project into the post-coelomic region (Fig. 8A). The lateral extensions are simple and show no trace of the convolutions present in *S. sihama*.

DISTRIBUTION

Known only from the east coast of the Gulf of Thailand, and India.

BIOLOGY

Unknown.

REMARKS

Sillago intermedius is similar to *S. sihama* but may be distinguished by the colouration and the simple lateral tubular extensions of the swimbladder. The tip of the inwardly projecting sub-ocular shelf on the third suborbital bone has a small spine-like process pointing posteriorly in *S. intermedius*.

Sillago (Sillago) parvisquamis Gill

Ya-gisu

(Figs. 2D, 7A, 13B, 14B, 15).

Sillago parvisquamis Gill, 1861, p. 505 (Kanagawa, near Yokohama). Jordan and Snyder, 1913, p. 187. Jordan and Hubbs, 1925, p. 248. Fowler, 1933, pp. 427–8. Tomiyama and Abe, 1958, pp. 1176–7. Shao and Chang, 1978, pp. 5–6; 1979, pp. 695–705.

Sillago sihama, Tanaka, 1913, p. 241, pl. 68, fig. 244 (non *Sillago sihama* Forskal).

MATERIAL EXAMINED

TYPES: *Sillago parvisquamis* Gill, Acad. Nat. Sci. Philadelphia, not examined.

OTHER MATERIAL: USNM 177416, Taipei, Taiwan, SU 7092 Tokyo, Japan. ZUMT 5724, off Haneda, Tokyo Bay, Japan.

DIAGNOSIS

Dorsal fins XII–XIII, 1, 20–22; anal fin II, 22–24; lateral line scales 70–84; 39–40 vertebrae; swimbladder with two posterior extensions.

DESCRIPTION

(Based on 2 examples from Tokyo, and 2 examples from Taiwan. SL 191, 143, 196 and 175 mm).

Dorsal fins XII–XIII, 1, 20–22; anal fin II, 22–24. Lateral line scales 79–84. TR, 7 above, 11–12 below; 6–7 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 3 rows, anterior ones cycloid, the posterior scales ctenoid (mostly ctenoid cheek scales).

Proportional dimensions as percent of SL: Greatest depth of body 14–17; head length 24.6–25.2, snout tip to ventral fin origin 27–29; snout tip to spinous dorsal fin origin 31–33; snout tip to second dorsal fin origin 54–55; snout tip to anal fin origin 54–56, least depth of caudal peduncle 5.3–6.3

Proportional dimensions as percent of head: Length of snout 38–43; horizontal diameter of eye 18–19; least width of interorbital 18–21.

VERTEBRAE: 16 abdominal, 5–6 modified, 17–19 caudal; 16 + 23–24, total 39–40. Tomiyama and Abe (1958, p. 1176) have recorded a total vertebrae count of 39. Japan 16–6–17 (2); Taiwan 16–6–17 (1), 16–5–19 (1).

COLOUR IN ALCOHOL: Pale brown to dull brown above, lighter below; a faint mid-lateral band usually present; dorsal fins dusky terminally with five or six rows of dusky spots on second dorsal fin membranes, other fins hyaline.

SWIMBLADDER: Two anterior extensions arise medially, diverge, and terminate on the basioccipital; two lateral extensions commence anteriorly, each with a blind tubule anterolaterally, and curve to invest the abdominal walls with a complex networklike arrangement of blind tubules; a duct-like process extends from the lateral surface to the urogenital aperture; two posterior tapering extensions project into the caudal region (Fig. 2D). The swimbladder is similar to that of *Sillago sihama* but the lateral arms have a more complex system of tubules.

DISTRIBUTION

Tokyo and Yokohama, Tokyo Bay, Japan; Taiwan.

BIOLOGY

Little known, the flesh is reported to be inferior to that of *Sillago japonica* (Tomiyama and Abe 1958, p. 1176).

REMARKS

Sillago parvisquamis is an elongate species with well developed frontal arches and an elongate otolith (Fig. 14B). In the high number of dorsal spines and vertebrae it approaches the genus *Sillaginodes* but the true relationship of the species appears to be with *Sillago sihama* as the swimbladder is remarkably similar in structure.

Sillago (Sillago) megacephalus Lin

Large-headed Whiting
(Fig. 2E)

Sillago megacephalus Lin, 1933, p. 96, fig. 3 (Paoping Harbour, Hainan, China). Fowler, 1949, p. 51.

DIAGNOSIS

Very similar to *Sillago sihama,* but with the head length 33 percent of standard length.

DESCRIPTION (from Lin 1933)

Dorsal fins XI, 22; anal 23. Lateral line scales about 70. TR. 5 above 10–11 below. Depth in length 6, head 3.1. Eye in head 4.7; snout 2.3; postorbital space 2.7; interorbital 6.4. Preopercular limb denticulated.

Colouration uniform; the tip of spinous dorsal blackish.

REMARKS

This species is known only from the unique holotype No. 883, 158 mm in SL, in the 'Fisheries Experiment Station', Canton. Efforts to locate the type were unsuccessful. *Sillago megacephalus* is unusual in having the head length 33 percent of the body length. *Sillago sihama* rarely has the head length to 30 percent, and in most specimens the head length is about 27–28 percent of SL. The dimensions from the figure of *S. megacephalus* give a head length of about 27 percent SL. The swimbladder structure and vertebral count is unknown.

Subgenus **Parasillago** subgen. nov.

Type species *Sillago ciliata* Cuvier, 1829.

DIAGNOSIS

This new subgenus differs from the subgenus *Sillago* in having the posterior extension of the swimbladder a single tapering projection or in one species a rounded posterior margin, instead of two posterior extensions. From *Sillaginopodys* this new subgenus differs in having the ventral fin without a club-like structure, swimbladder well developed, and a duct-like process from the ventral surface of the swimbladder to the urogenital aperture.

REMARKS

Sixteen species and four subspecies are included in this subgenus. The swimbladder in *Sillago macrolepis* and *Sillago attenuata* lack a well developed posterior extension to the swimbladder, and in the former species modified caudal vertebrae are absent. The swimbladder of *Sillago argentifasciata* and *Sillago microps* sp. nov. is unknown at present, and these species have been provisionally placed in this subgenus pending further investigation. All other species have a single posterior tapering extension to the swimbladder.

KEY TO THE SPECIES OF THE SUBGENUS *PARASILLAGO*

1. — A dark brown, dusky or blue-black spot or blotch on or just preceding the pectoral fin base 2
   — No dark mark at base of pectoral fin although a bright yellow or orange spot may be present 6
2. — Body with dark blotches or rusty brown bars 3
   — Body uniform colour in adults (juveniles up to 90 mm may have darker blotches along the sides and back) with the snout bluish in some large specimens; dorsal fins XI, 1, 16–18; anal fin II, 15–17; lateral line scales 60–69; vertebrae 14–15 + 5–8 + 11–14, total 32–34, swimbladder with rudimentary tubules projecting anteriorly and a series of sawtooth like pockets laterally (Fig. 9E–H) Eastern Australia ..... *Sillago ciliata* (p. 15)

3 — Body with 8–11 oblique well-defined rusty-brown bars dorsally; dorsal fins XI, 1, 17–19; anal fin II, 16–18; lateral line scales 65–70; vertebrae 13–14 + 8–12 + 7–10, total 32–34; swimbladder with a median anterior projection and very rudimentary anterolateral projections (Fig. 10C). Western Australia ....*Sillago vittata* new species (p. 20)
— Body without well defined rusty brown bars 4

4. — Upper and lower dark blotches on sides joined at least posteriorly; dorsal fins XI (rarely XII), 1, 19–21; anal fin II, 18–20; lateral line scales 69–75; vertebrae 13–15 + 8–11 + 10–14, total 34–36; swimbladder with a short median extension anteriorly and a complex anterolateral extension that continues posteriorly to the level of the duct-like process (Fig. 7B). Eastern Australia ....*Sillago maculata maculata* (p. 22)
— Upper and lower dark blotches separate; swimbladder without complex anterolateral extensions extending posteriorly to duct-like process 5

5. — Four rudimentary anterolateral extensions that are normally convoluted (Fig. 10B); usually 19–20 anal rays; usually 35 vertebrae. Western and northern coasts of Australia, southern New Guinea and Indonesia ..... *Sillago maculata burrus* (p. 24)
—Three rudimentary anterolateral extensions that may be simple or convoluted (Fig. 10A); usually 18 anal rays; vertebrae 34. West Pacific except Australia and southern New Guinea .....*Sillago maculata aeolus* (p. 27)

6. — Body with oblique narrow rusty-brown bars that may be partly broken into lines of more or less contiguous rusty-brown or orange-brown spots 7
— Body without oblique rusty-brown bars; some faint dark blotches or small spots may be present in juveniles less than 100 mm in standard length 8

7. — A longitudinal row or brown or rusty-brown blotches along middle of side on or below lateral line; belly pale, not silvery; upper oblique bars not formed of lines of contiguous rusty-brown spots; mid-lateral silvery band generally indistinct; vertebrae 13 + 9–11 + 9–11 Eastern Australia .....*Sillago bassensis flindersi* new subspecies (p. 29)
— No longitudinal row of brown or rusty-brown blotches on or below lateral line; belly silvery; upper oblique bars usually formed of lines of contiguous rust-brown to orange brown spots; mid-lateral silvery band conspicuous; vertebrae 12–14 + 12–14 + 7–9. Western Australia, South Australia and western Victoria ....*Sillago bassensis bassensis* (p. 28)

8. — Base of first dorsal spine of adult specimens with a sharply keeled anterior edge bearing on the lower part a white or pale yellow spot with a black or black-brown spot above; dorsal fins XI, 1, 16–18; anal fin II, 16–19; lateral line scales 64–70; vertebrae 13 + 8–12 + 8–12, total 33; swimbladder as in Figures 11D-J. Australia ....*Sillago robusta* (p. 30)
— Base of first dorsal spine not keeled and without a black spot or blotch above a white or yellow base 9

9. — Total vertebrae 37–39; lateral line scales usually more than 73 (except *S. schomburgkii*) 10
— Total vertebrae 32–36; lateral line scales usually less than 73 (except *S. japonica* and *S. indica*) 12

10. — 21–22 anal rays; dorsal fins XI, 1, 21; vertebrae 38. Gulf of Tongking and China .....*Sillago boutani* (p. 34)
— 17–20 anal rays; X-XIII dorsal spines; vertebrae 37–39 11

11. — Anterior margin of swimbladder concave; dorsal fins X-XII, 1, 19–20; lateral line scales 66–76; vertebrae 16–17 + 8–11 + 10–13, total 37. Western Australia and South Australia .. ..*Sillago schomburgkii* (p. 34)
— Anterior margin of swimbladder convex; dorsal fins XII–XIII, 1, 19–21; lateral line 73–77; vertebrae 15 + 2 + 20, total vertebrae counts range from 37–39. Persian Gulf ....*Sillago attenuata* new species (p. 36)

12. — Swimbladder with anterolateral extensions recurved posteriorly 13
— Swimbladder without anterolateral extensions recurved posteriorly 15

13. — Swimbladder as in Figure 5E; lateral line scales 69–80. India ....*Sillago indica* new species (p. 38)
— Swimbladder as in Figure 10E; lateral line scales 64–70 14

14. — Membrane of second dorsal fin with a more or less continuous grey band formed of minute black dots, running parallel to and closer to anterior edge of each ray; extensions of swimbladder extend to less than half length of swimbladder. India ....*Sillago soringa* (p. 38)

— Membrane of second dorsal fin without a more or less continuous grey band but with margin of fin finely spotted with brown or black; extensions of swimbladder extend posteriorly to almost half length of swimbladder. Thailand and Taiwan ....*Sillago asiatica* (p. 36)

15. —Lateral line scales 61 or less 16
— Lateral line scales 64 or more 17

16. — 14–17 anal rays. Southern New Guinea and northern Australia ....*Sillago analis; Sillago nierstraszi* (p. 18)
— 19–21 anal rays. Indonesia to Philippines excluding Australia ..... *Sillago macrolepis*

17. — A brilliant silvery mid-lateral longitudinal band. Lumbucan Is., Philippines ....*Sillago argentifasciata* (p. 40)
— Mid-lateral band not well developed ... 18

18. — 21–24 anal rays 19
— 17–19 anal rays 21

19. — Swimbladder with a small bulbous anterior projection and without anterolateral extensions projecting anteriorly. West coast of India ..... *Sillago vincenti* (p. 45)
— Swimbladder with a pointed median anterior extension and anterolateral extensions projecting anteriorly 20

20. — Usually 13 abdominal vertebrae; 5 scales between lateral line and spinous dorsal origin. Northern Australia ....*Sillago lutea* new species
—Usually 14 abdominal vertebrae; 3 scales between lateral line and spinous dorsal origin. Japan, Korea, China and Taiwan .....*Sillago japonica* (p. 42)

21. — Dorsal fin rays 17; anal fin rays 17; cheek scales ctenoid; vertebrae 13+9–11+9–11, total 33; eye diameter 19–23 percent of head length Thailand to northern Australia ....*Sillago ingenuua* new species (p. 44)
—Dorsal fin rays 19; anal fin rays 19; cheek scales cycloid; vertebrae 13+5+16, total 34; eye diameter 14–16 percent of head length. Taiwan ...*Sillago microps* new species (p. 44)

Sillago (Parasillago) ciliata Cuvier

Sand Whiting

(Figs. 1A, 3A, 9E–H, 13K, 14D–E, 17)

Sillago ciliata Cuvier, in Cuvier and Valenciennes, 1829, p. 415 (Southern Seas). Valenciennes, 1839, pl. 13, fig. 2. Günther, 1860, p. 245; 1880, p. 42. Gill, 1862, p. 504. Jouan, 1861, p. 272. Kner, 1865, pp. 127–8. Steindachner, 1866, pp. 443–4. Schmeltz, 1869, p. 16; 1879, p. 44. Castelnau, 1875, p. 16. Alleyne and Macleay, 1877, p. 279. Klunzinger, 1879, p. 369. Macleay, 1881, p. 202. Tension-Woods, 1882, p. 65, pl. 24. Ogilby, 1886, p. 31. McCoy, 1890, p. 229, pl. 182. Cohen, 1892, p. 17. Kent, 1893, pp. 292, 370, pl. 45, fig. 2. Waite, 1901, p. 47; 1904, p. 206. Stead, 1906, pp. 574–6; 1908, p. 63, pl. 33. McCulloch, 1911, p 62; 1921, p. 60; 1927, p. 50. Cokerell, 1915, pp. 41–2. Fowler, 1928, p. 235; 1933, pp. 428–30; 1953, p. 15. Starks, 1929, p. 253. Weber and de Beaufort, 1931, pp. 171, 178. Whitley, 1932, pp. 344–5; 1955, p. 33; 1964, p. 43. Hardenberg, 1941, p. 228. Cleland, 1947, pp. 215–28. Roughley, 1951, pp. 46–8. Legand, 1952. Munro, 1945; 1958, p. 178; 1967, p. 346. Parrott, 1959, p. 201. Woodland and Slacksmith, 1963, p. 32. Marshall, 1964, p. 170. Grant, 1965, p. 84; 1972, p. 243. Lanzing, 1967, p. 242. Lanzing and Hynd, 1967, pp. 177–8.

Sillago diadoi Thiolliere, 1857, p. 151 (Woodlark Island, Paupa).

Sillago insularis Castelnau, 1873, p. 232 (Noumea, New Caledonia).

Sillago terra-reginae Castelnau, 1878, p. 232 (Moreton Bay, Queensland).

Sillago bassensis Castelnau, 1879, p. 381. Macleay, 1881, p. 567. Kent, 1893, p. 291. Tosh, 1902, pp. 175–184 (non *Sillago bassensis* Cuvier).

Sillago ciliata diadoi, Whitley, 1932a, pp. 344–5.

Sillago gracilis Whitley, 1932b, p. 284 (non *Sillago gracilis* Alleyne and Macleay).

MATERIAL EXAMINED

TYPE: *Sillago ciliata* Cuvier. A radiograph of the holotype registered A3133 in the Museum National D'Histoire Naturelle, Paris, forwarded by Dr M. Blanc, Vertebrae 14.6.13.

Sillago diadoi Thiolliere. Not examined; location of holotype unknown.

Sillago insularis Castelnau. Not examined; location of holotype unknown.

Sillago terra-reginae Castelnau. The holotype is registered A5636 in the Museum National D'Histoire Naturelle and consists of a dried skin only. Dr M. Blanc kindly re-examined the holotype and confirmed that 10 dorsal spines, and 61 lateral line scales were present. Castelnau (1878, p. 232) records 64 lateral line scales.

OTHER MATERIAL: New South Wales (124); WAM P0620–34, Bermagui; WAM PO476–90, Botany Bay; WAM P0585–94, WAM P0635–9, Manning River, USNM 93125, Newcastle; QM I12955, Port Jackson; QM I8013–4 Port Stephens; WAM P15540–8, WAM P0172–5, WAM P0264–72, WAM P0314–36, USNM 83051, QM I10326 (21), Sydney; SOSC 560, Tuggerah Lake; QM I2961–2, Tweed Heads, USNM 59886 (4), New South Wales. Queensland; QM I12762 (88) Brisbane Fish Markets (vertebrae only); WAM P0464, Brisbane River; CSIRO C3163, Caboolture River; WAM P0460, Dunwich; USNM 176902 (11), Great Barrier Reef; USNM 177160, Lindeman Island; QM I1185, QM I2957, QM I11541, Moreton Bay; QM I2992, QM I2954, Nerang River; QM I2935–47 (40) Southport; QM I11451, Tewantin, Lord Howe Island (4); AM I4641–2, AM 4673–4. New Caledonia (8), WAM P15654–61, Noumea.

DIAGNOSIS

Dorsal fins XI, 1, 16–18; anal fin II, 15–17; lateral line scales 60–69; a dark spot at the base of the pectoral fin; colouration of adult specimens uniform without darker bars or blotches.

DESCRIPTION

Dorsal fins XI, 1, 16–18; anal fin II, 15–17 (see Table 7). Lateral line scales 60–69 usually 63 (see Table 8). TR. 6 above, 12–13 below, 5–7 scales, usually 6, between L. lat. and spinous dorsal fin origin. Cheek scales in 4–5 rows, cycloid and ctenoid (usually more cycloid scales).

Proportional dimensions as percent of SL: greatest depth of body 21–23; head length 27–31; snout tip to ventral fin origin 30–34; snout tip to spinous dorsal fin origin 34–37; snout tip to second dorsal fin origin 58–61; snout tip to anal fin origin 59–65; least depth of caudal peduncle 9–10.

Proportional dimensions as percent of head: length of snout 40–48; horizontal diameter of eye 16–20; least width of interorbital 17–20.

VERTEBRAE: 14–15 abdominal, 5–8 precaudal, 11–14 caudal; 14–15 + 18–20, total 32–34 (see Table 9).

COLOUR IN ALCOHOL: Body pale brown or silvery-brown, whitish below, with green, mauve, and rosy reflections when fresh; a broad but rather indistinct silvery-yellow mid-lateral band; spinous dorsal pale olive-green with faint darker blotches, second dorsal fin pale olive with rows of dark-brown to blackish spots; anal and ventrals pale yellowish; pectorals pale yellow or pale brown with a well defined dark, or blue-black base; caudal yellowish to olive, with a darker margin. Juveniles up to 80 or 90 mm may have darker blotches along the sides and back.

SWIMBLADDER: Anterior part of the swimbladder with rudimentary tubules projecting anteriorly and a series laterally that diminish in size and become sawtooth-like posteriorly. Some individual variation in the shape of the anterior extensions is shown in Figure 9E–H; the posterior extension is single, tapering, and projects well into the caudal region; a duct-like process from the ventral surface to the urogenital aperture is present. The shape of the swimbladder is not distinguishable from *Sillago analis*.

GEOGRAPHIC VARIATION

The dorsal and anal fin rays remain fairly constant in the three samples given in Table 7. The lateral line scale counts of the sample from Magenta and Dumbea, New Caledonia, recorded by Legand (1952, p. 112) differs from the Australian material given in Table 8, although my 8 examples from Noumea do not depart significantly from the Australian specimens. It seems likely that Legand included the few scales on the base of the caudal fin in addition to those of the body.

The vertebrae counts of the four specimens from New Caledonia are insufficient to indicate any real variation; a larger sample is required.

DISTRIBUTION

East coast of Australia from Cape York, Queensland, southwards along the coast and the Great Barrier Reef to eastern Victoria, and the east coast of Tasmania. Most common in southern Queensland, and New South Wales. This species also occurs at Lord Howe Island, New Caledonia, and Woodlark Island, Papua. Hardenberg, 1941, p. 228 listed this species from Japero, West Irian, but this record may refer to *S. analis*.

BIOLOGY

Sillago ciliata is an onshore species occurring on coastal beaches, sandbars and surf zones as well as open bays, estuaries and coastal lakes; occasional specimens have been taken in offshore waters to 23 fathoms during winter. Sand whiting enter estuaries and penetrate far upstream to the tidal limits of rivers and creeks where juveniles and adolescent fish may be abundant. The adults congregate around the mouths of estuaries, bars, and spits, in depths of up to three fathoms. Tosh (1903) described the egg and larval development and gives the spawning period as September to February. Tosh also describes the habits of this species and mentions 'Soon after the beginning of the spawning season young whiting of 10 mm and over can be observed swimming actively in small droves of from 10 to 20 on sand flats and beaches. They move up and down with the tide, swimming in very shallow water. As they grow older they keep further from the shore. The whiting may be said to live almost exclusively on sandy ground. The adults appear to be gregarious only at spawning time.

The most characteristic habit of the whiting is that of burrowing in the sand to escape from enemies. In so doing the fish literally dives into the sand. The dive can be executed with great rapidity and is a most serviceable accomplishment. When fishing for whiting with a seine net one can observe as the bunt of the net nears the shore here and there a small cloud of sand thrown up; the fisherman marks the place, and when his net is in, wades out and feels about

in the sand with his feet; when a fish moves under his feet he stamps his foot down to hold it there, and then picks it up with his hand. Often as many as a dozen fish are so taken which had otherwise escaped the footrope of the net. Very small whiting, an inch and a half long, have the trick. When burying the whiting throws up its tail, and actually takes a header into the sand using its tail fin vigorously. Once the head is under, it appears to throw up like a diver, and when buried has got into a horizontal position. The whiting can remain down for 2 or 3 minutes. On an ordinary sand flat, a whiting can bury itself to a depth of from 3 to 4 inches, but on a hard sand beach, it can hardly cover itself.

When taken the whiting often makes a short, croaking, frog-like sound — whence the name trumpeter'.

Cleland (1947) has reported on the fishery, fishing methods, and biology, including raciation, food, reproduction, age determination and growth, pathology and condition of the fishery.

Legand (1952) describes the growth of the postlarvae of *S. ciliata* from New Caledonia and Munro (1945) the postlarvae from the Noosa River, Queensland.

Sillago ciliata grows to a length of 45 cm.

Remarks

Sillago ciliata and *Sillago analis* are sibling species that can be separated by colouration and in most cases lateral line scale counts. The vertebrae count and swimbladder shape is similar or identical in both species. If both were allopatric in distribution the differences between the two species would be considered of subspecific rank only. In Queensland both species occur in the same school, or separately, from Moreton Bay northwards to Cape York. In New South Wales *S. ciliata* is common but *S. analis* is absent; in the Northern Territory and the northern half of Western Australia *S. analis* is abundant but *S. ciliata* is absent.

In the '*ciliata* group' of species is also *S. ingenuua* from Thailand and northern Australia.

TABLE 7: Frequency Distributions of Dorsal and Anal Fin Rays of *Sillago ciliata*

Dorsal rays	16	16	17	17	17	18	18	18
Anal rays	15	16	15	16	17	15	16	17
New South Wales	2	7	8	57	4	1	2	2
Queensland	1	2	6	42	3	–	4	–
New Caledonia	1	–	–	6	–	1	–	–

TABLE 8: Frequency Distributions of Lateral Line Scales of *Sillago ciliata*

Lateral scales	60	61	62	63	64	65	66	67	68	69
New South Wales	1	6	16	22	17	12	5	–	–	–
Queensland	–	1	8	18	6	2	2	–	–	–
New Caledonia	–	1	3	3	1	–	–	–	–	–
New Caledonia*	9	1	2	9	8	491	85	25	11	5

*from Legand (1952, p. 112).

TABLE 9: Vertebrae of *Sillago ciliata*

Abdominal	13	14	14	14	14	14	14	14	15	15	15
Modified	7	5	6	7	7	7	8	8	6	6	7
Caudal	13	14	13	11	12	13	11	12	12	13	12
New South Wales	–	–	22	2	47	1	10	1	2	1	–
Queensland	1	–	17	1	53	2	11	–	1	–	1
New Caledonia	–	1	3	–	–	–	–	–	–	–	–

Sillago (Parasillago) analis Whitley

Golden-lined or Rough-scale Whiting
(Figs. 3B, 9A–D, 13L, 14F, 17)

Sillago ciliata: Paradice and Whitley, 1927, p. 89. Taylor 1964, p. 174 (non *Sillago ciliata* Cuvier).

Sillago analis Whitley, 1943, p. 184 (Shark's Bay, Western Australia); 1948, p. 19; 1954, p. 27; 1964, p. 43. Haysom, 1957, p. 141. Grant, 1965, p. 85; 1972, p. 244.

MATERIAL EXAMINED

TYPE: *Sillago analis* Whitley. A radiograph of the holotype registered I 13118 in the Australian Museum, Sydney. The vertebrae number 14–6–13.

OTHER MATERIAL: Western Australia (68): WAM P13980–9, WAM P0584, WAM P0640–1, Broome; WAM P0360, WAM P0766–8, Exmouth Gulf; WAM P12699–700; Kalumburu; WAM P0466, Nichol Bay; WAM P12978, WAM P0176, WAM P0798–800, Port Hedland; WAM P7674–5, WAM P12773–8, WAM P12974–7, WAM P12982–7, WAM P13189–91, WAM P13203–13, WAM P13222, WAM P14979–82, WAM P027–9, WAM P15047–9, Shark Bay. Northern Territory (65): USNM 174057 (9), Cape Arnhem; USNM 174051, Darwin; USNM 174052 (4), USNM 174053 (7), USNM 174054 (16), Groote Eylandt; USNM 174056 (16), Port Bradshaw; QM (4), I13164, I13168, I13170, Shoal Bay; QM I3992 Sir Edward Pellew Islands, Queensland (88); CSIRO C3164–6, Caboolture; QM I3255, Cribb Island; QM I12736 (68), Deception Bay; QM I11099, Gibson Island; CSIRO C3167–70, Maryborough; WAM P0461, WAM P13835, CSIRO C2981, Moreton Bay; QM I12694, Norman River, Gulf of Carpentaria; AM IB3219–22, QM F3218, Scarborough; AM IB3765–6, Tin Can Bay. New Guinea (10): QM I13215–17, Daru Island.

DIAGNOSIS

Dorsal fins XI, I, 16–18; anal fin II, 14–17; lateral line scales 54–61; no dark spot at base of pectoral fin.

DESCRIPTION

Dorsal fins XI, I, 16–18; anal fin II, 14–17 (Table 10). Lateral line scales 54–61 (Table 11); TR. 5–6 above, 6–8 below, 4–5 (usually 4) scales between L. lat. and spinous dorsal origin. Cheek scales in 3–4 rows (usually 4), the anterior scales cycloid, the posterior scales ctenoid (cheek scales mostly cycloid).

Proportional dimensions as present SL: greatest depth of body 19–22; head length 28–32; snout tip to ventral fin origin 29–34; snout tip to spinous dorsal fin origin 34–39; snout tip to second dorsal fin origin 58–61; snout tip to anal fin origin 59–64; least depth of caudal peduncle 9–11.

Proportional dimensions as percent of head: length of snout 37–44; horizontal diameter of eye 19–25; least width of interorbital 14–18.

VERTEBRAE: 13–14 abdominal, 4–8 modified, 11–15 caudal; 13–14 + 19–20, total 33–34 (see Table 12).

COLOUR IN ALCOHOL: Body with a dark grey lateral stripe; head dusky, spotted with fine black spots, snout darker; margins of scales on opercles and body dark, forming a faint mesh-like pattern on upper sides; dorsal fins with membranes dusky and streaked with brown; caudal fin dusted with black; anal fin hyaline; pectoral fin with fine dusky black spots at base but no dark spot; pelvic fins with membrane between outer rays finely spotted, remainder of fin hyaline.

COLOUR IN LIFE: Body light silvery, slightly darker to dusky above; a dull golden-silver to golden-yellow band longitudinally on sides below lateral line; pelvic and anal fins pale yellow to bright yellow; pectoral fin with a darker dusting of fine black-brown spots, base without a black spot.

SWIMBLADDER: As for *Sillago ciliata*, see Fig. 9A–D.

GEOGRAPHIC VARIATION

The lateral line scale counts for south-east Queensland are greater than those from Western Australia, and the vertebrae counts have one or two additional modified vertebrae. A series of samples from northern Australia is required to verify this variation.

DISTRIBUTION

Shark Bay, Western Australia, Northern Territory, Queensland south to Moreton Bay, and southern coast of New Guinea.

BIOLOGY

Lenanton (1969a, 1969b) has described the Shark Bay fishery and records that the juveniles of this species, together with those of *Sillago schomburgkii*, 'remain in the warmer waters of the shallow mangrove creek shorelines and protected inlets. On reaching maturity *Sillago analis* prefer the muddy, tidal streams but *Sillago schomburgkii* are located on the more open, sandy banks'. Spawning takes place from September to January.

The juvenile fish are marked with about 8 dark blotches on the mid-lateral line, 12 blotches along the dorsal line at the base of the fins, and about 7 blotches between the dorsal and lateral series. One specimen from Moreton Bay had 10 evenly spaced faint dark bars on the upper sides that reached the lateral line anteriorly but terminated before the mid-lateral line posteriorly; a dark longitudinal mid-lateral stripe may be present.

TABLE 10: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO ANALIS*

Dorsal rays	16	16	16	16	17	17	17	17	18	18	18
Anal rays	14	15	16	17	14	15	16	17	15	16	17
Western Australia	1	6	3	–	3	22	24	1	1	–	1
Northern Territory	–	1	1	–	–	1	31	3	–	4	3
Queensland	–	2	6	–	–	6	72	1	–	1	2
New Guinea	–	–	–	1	–	1	7	1	–	–	–

TABLE 11: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO ANALIS*

Lateral Line Scales	54	55	56	57	58	59	60	61
Western Australia	4	5	16	15	12	11	1	1
Northern Territory	–	3	8	7	6	3	3	3
Queensland	–	–	–	5	8	29	27	15
New Guinea	–	–	4	–	3	3	–	–

TABLE 12: VERTEBRAE OF *SILLAGO ANALIS*

Abdominal	13	14	14	14	14	14	14
Modified	6	4	5	6	6	7	8
Caudal	14	15	14	13	14	12	11
Western Australia	1	–	21	7	1	–	–
Northern Territory	–	–	10	3	–	–	–
Queensland	–	–	4	20	–	7	1
New Guinea	–	1	5	2	1	–	–

Sillago analis is most abundant in silty areas of Shark Bay and Moreton Bay, and is common among mangrove areas inside Exmouth Gulf. This species grubs in the silty-sand substrates for worms and has been observed to 'plough' up the bottom with the snout. The small fish may be seen feeding in very shallow water where they occur in schools moving slowly across the bottom; on occasions a fish will hover motionless, and then dart the snout into the ground to seize prey. Food is predominantly marine worms and the fish move across the sand with the first ray of the ventral fins in contact with the substrate. A number of *Sillago* species maintain ventral ray contact with the bottom whilst feeding, the juveniles usually have the first one or two ventral rays elongate. The highly developed sensory canal system on the head, particularly the lachrimal and subpreopercular canals, may receive vibrations from prey organisms in the sand, as *S. analis* has been observed to dig into the bottom to capture prey, and then move slowly across the bottom to abruptly stop and dig again; this behaviour does not appear to be of random nature.

The maximum size attained is about 45 cm.

REMARKS

Sillago nierstraszi is almost certainly a senior synonym of *S. analis*. The holotype of *S. nierstraszi* was unavailable for study. *Sillago ciliata* is very similar in all characteristics and both species may be found together along the east coast of Queensland. *S. ciliata* can be distinguished from *S. analis* by the presence of a black spot on the pectoral base. The juveniles are remarkably similar and not all specimens appear to have the pectoral base slightly darker in Moreton Bay specimens; if hybridisation occurs the gene flow between species must be slight, as the great majority of specimens from eastern Queensland are clearly identifiable.

Sillago (Parasillago) nierstraszi Hardenberg

Rough Whiting

Sillago nierstraszi Hardenberg, 1941, p. 288 (Merauke, New Guinea). Munro, 1958. p. 178.

MATERIAL EXAMINED

TYPE: The location of the holotype is unknown. Dr W. Saetikno, of the Museum of Zoologicum Bogoriense informs me that the holotype is not present in that Museum.

DIAGNOSIS

Possibly a senior synonym of *Sillago analis*.

DESCRIPTION (from Hardenberg, 1941)

Dorsal fins XI, 1, 17; anal II, 17; pectoral 14. Lateral line scales 5 (50+?). TR. 4-1-13.

Height 5.2, head 4 in length. Rostrodorsal profile slightly convex. Scales on head ctenoid. Eye 6 in head, more than twice in snout. Interorbital space about 1.5 in snout, which goes 2.2 in head. Mouth small, terminal, far before eye. Lower jaw included. Hindborder of praeoperculum with fine crenulations. A small but strong spine on operculum. Two series of scales on cheeks, four on operculum. Villiform teeth in jaws and on vomer and palatines. Dorsals approximate. Longest rays of first dorsal somewhat longer than head without snout. Second dorsal gradually decreasing in height posteriorly, longest rays about as long as postorbital part of head. Anal decreasing in height posteriorly, its longest rays shorter than postorbital part of head. Unpaired fins with interradial scales. Caudal somewhat emarginated. Pectorals and ventrals about equally long, about as long as head without snout. Colour of formol specimen completely faded.

DISTRIBUTION

Known only from the Holotype.

REMARKS

Hardenberg (1941, p. 288) states that this species is related to *Sillago macrolepis* according to the lateral line scales (*macrolepis* has 52-56 lateral line scales), but differs in the TR count, the smaller eye, the low anal ray count, and in having ctenoid scales on the head. In most features *Sillago nierstraszi* is similar to *Sillago analis* and may prove to be a senior synonym. It is unlikely to be a junior synonym of *Sillago ciliata* as the location is outside the range of that species and the black pectoral spot of *S. ciliata* is present in preserved specimens retained in formalin or alcohol for many years. The location of the holotype is unknown and therefore the vertebrae count and the correct number of lateral line scales was not available to me. Further collecting at the type locality may establish the identity of *S. nierstraszi*.

Sillago (Parasillago) vittata new species

Banded Whiting

(Figs. 4B, 10C, 13M-O, 14L, 17)

MATERIAL EXAMINED

TYPE: Holotype: SL 209 mm, collected in 17 to 20 fathoms north-east of Rottnest Island, Western Australia, September, 1965, R.J. McKay. Registered WAM P14172 in the Western Australian Museum.

PARATYPES: WAM P19230, Maud Landing; WAM P14158-71, WAM P14173-6, NE of Rottnest Island; WAM P14983, WAM P15242-46, Shark Bay; WAM PO 190-204, Dirk Hartog Island, Shark Bay.

DIAGNOSIS

Dorsal fins XI, 1, 17-19; anal fin II, 16-18; lateral line scales 65-70. Swimbladder with a median anterior extension and very rudimentary anterolateral projections. Pectoral fin base with a dusky spot, and body with 8-11, light brown to rusty-brown very narrow bars extending from the back obliquely forwards to touch or almost touch a conspicuous silvery mid-lateral longitudinal band.

DESCRIPTION

(Based on the holotype and 24 paratypes from NE of Rottnest Island, and Shark Bay, SL 159-231 mm. Characters for the holotype given in parentheses).

Dorsal fins XI, 1, 17-19 (XI, 1, 18); anal fin II, 16-18 (ii, 17) (Table 13). Lateral line scales 65-70 (67) (Table 14). TR. 6-7 above, 7-9 below (7/9), 6 scales between L. lat. and spinous dorsal origin. Cheek scales in 3 rows, the upper row mostly cycloid, the lower rows ctenoid.

Proportional dimensions as percent of SL: greatest depth of body 19-21 (21.0); head length 27-31 (30.6); snout tip to ventral fin origin 28-32 (31.2); snout tip to spinous dorsal fin origin 33-36 (36.4); snout tip to second dorsal fin origin 56-60 (59.4); snout tip to anal fin origin 57-61 (58.9); least depth of caudal peduncle 7-9 (8.1).

Proportional dimensions as percent of head: Length of snout 40-47 (44.5); horizontal diameter of eye 16-21 (20.3); least width of interorbital 16-20 (17.2).

VERTEBRAE: 13-14+8-12+7-10, 13-14 abdominal, 19-21 caudal, total 32-34 (Table 15).

COLOUR IN ALCOHOL: Head and body pale sandy brown to light fawn, a distinct silvery mid-lateral band is present, opercles and breast silvery, pale below; 8-11 very narrow (about scale width) brown bars extend from the dorsal midline obliquely forwards and downwards to touch or almost touch the mid-lateral band, the bar between the dorsal fins and the next posterior one frequently superimposed on the mid-lateral band; spinous dorsal fin with brown blotches and the tip dusky, the rayed dorsal fin with 2 to 3 rows of spots forming longitudinal lines; anal ventral, and caudal unmarked; pectoral fin hyaline with the base silvery and a dark, round, purple-brown or brown spot formed of fine dots superimposed on

the area between the gill opening and pectoral base; belly pale with the mid-line silvery-white; breast silvery white, opercle and preopercle silvery.

COLOUR IN LIFE: Head and body light tan above paler below; with the breast and ventral surface of belly silvery-white with blue, mauve, and yellow reflections; opercles silvery with lemon-yellow to yellow blush and fine black dusting above; 8–11 rusty-brown to brown oblique bars of about half a scale in width extend from the dorsal midline forwards and downwards to touch or overlap the distinct silvery-white mid-lateral band that commences behind the opercles and extends to caudal fin base; pectoral fin pale lemon-yellow to hyaline with a large rounded dark brown to pale bluish-brown spot on a silvery background just before the base; spinous dorsal fin with the membrane white below, yellowish above, with some brown blotches and black dusting apically, rayed dorsal fin white at base, lemon above, and with about 3 rows of brown blotches forming longitudinal lines; anal fin bright yellow with a pale base and white margin; ventral fins white with a pale lemon-yellow centre; caudal fin lemon-yellow to yellow.

SWIMBLADDER: Similar to *Sillago robusta* and *Sillago bassensis bassensis* in having a median anterior extension and rudimentary anterolateral projections; a duct-like process is present on the ventral surface; posterior extension single and tapering.

GEOGRAPHIC VARIATION

No geographic variation found.

DISTRIBUTION

Maud Landing southwards to Rottnest Island, Western Australia.

BIOLOGY

Inside Shark Bay this species was known as the 'bastard whiting' by fishermen who found that on occasions *S. vittata* comprised up to 20 percent of the whiting catch near 'The Loop' grounds, Dirk Hartog Island. This species is most common near weed banks and coral reefs in shallow-water and is associated with *S. maculata burrus, S. schomburgkii* and *S. analis*. At Maud Landing *S. vittata* may be taken by hook and line from the beach but off Rottnest Island large catches may be taken by trawl net in 17 to 20 fathoms where the species is in association with *S. robusta, S. bassensis bassensis,* and *S. maculata burrus*. In southern waters *S. vittata* is not captured in shallow water and was unknown until exploratory trawling by L.F.B. 'Bluefin' off Rottnest Island. Reports of 'narrow-barred whiting' off Fremantle by line fishermen operating in 20 to 30 fathoms possibly refer to *S. vittata* as the school whiting *S. bassensis bassensis* is well known to fishermen as 'poddy whiting' on the south-western coast of Australia.

Maximum length recorded is approximately 30 cm, but unverified reports of larger fish from Shark Bay were received; one large specimen was of a golden-yellow colour with brown bars.

REMARKS

Sillago vittata may be separated from *Sillago maculata burrus* by colouration, the morphology of the swimbladder, in having mostly ctenoid cheek scales, and by vertebrae counts. The fin ray counts of *S. vittata* are normally 18 dorsal and 17 anal (20 dorsal, 19 anal in *S. maculata burrus*). The eye width-snout length relationship is different in most specimens (Table 16).

From *Sillago bassensis bassensis* this new species differs in colouration; the oblique bars are more distinct and pectoral fin has a dark round blotch or spot before the base. The fin ray counts are usually 18 dorsal and 17 anal in *S. vittata*, and 18 dorsal and 19 anal in *S. bassensis bassensis*. The vertebrae are typically 13 + 12 + 9 or 13 + 13 + 8, 13 + 21 in *S. bassensis bassensis* and 13 + 11 + 9, 13 + 20 in *S. vittata*. The frontal bone arches are wider in *S. vittata* than in *S. bassensis bassensis*, and the shape of the suborbital shelf is quite different (Figs. 13M–O).

DERIVATION

From the latin 'vittatus' meaning banded.

TABLE 13: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO VITTATA*

Dorsal rays	17	18	18	18	19	19
Anal rays	17	16	17	18	17	18
Rottnest Island	1	1	13	–	3	1
Shark Bay	2	1	18	1	1	1

TABLE 14: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO VITTATA*

Lateral line scales	65	66	67	68	69	70
Rottnest Island	3	6	11	4	–	1
Shark Bay	2	2	1	–	–	–

TABLE 15: VERTEBRAE OF *SILLAGO VITTATA*

Abdominal	13	13	13	13	13	14	14	14
Modified	10	11	12	12	12	9	10	11
Caudal	10	9	7	8	9	10	9	8
Rottnest Island	–	–	–	1	–	–	–	–
Shark Bay	1	20	1	1	1	1	5	2

TABLE 16: EYE WIDTH AND SNOUT LENGTH RELATIONSHIP IN *SILLAGO VITTATA*, *SILLAGO MACULATA BURRA* AND *SILLAGO BASSENSIS BASSENSIS*

Snout length	1.4	1.6	1.8	2.0	2.2	2.4	2.6
Eye diameter	1.5	1.7	1.9	2.1	2.3	2.5	2.7
S. vittata	–	–	–	4	13	5	2
S. maculata burra	4	3	19	6	1	–	–
S. bassensis bassensis	–	10	12	6	1	–	–

Sillago (Parasillago) maculata maculata Quoy and Gaimard

Trumpeter Whiting
(Figs. 3C, 7B, 13P, 14G, 16)

Sillago maculata Quoy and Gaimard, 1824, p. 261, pl. 5, fig. 2. (Sydney, New South Wales). Cuvier, 1829, p. 411. Bleeker, 1849, pp. 5, 8, 10, 14, 62; 1858, p. 161; 1874, p. 71 (part). Günther, 1860, p. 245. Steindachner, 1866, pp. 444–5; 1870, p. 562. Castelnau, 1875, p. 16; 1879, p. 380. Alleyne and Macleay, 1876, p. 279. Klunzinger, 1879, p. 370. Schmeltz, 1879, p. 44. Macleay, 1881, p. 201. Tenison - Woods, 1883, p. 65, pl. 23. Pohl, 1884, p. 32. Ogilby, 1886, p. 31; 1893, p. 101. Johnston, 1891, p.33. Cohen, 1892, p. 16. Waite, 1898, p. 30; 1889, p. 109; 1902, p. 190; 1904, p. 31. Stead, 1906, pp. 574–6; 1908, p. 64. McCulloch, 1911, p. 61; 1921, p. 61, 1927, p. 51, pl. 21, fig. 1846. Weber, 1913, p. 267. Fowler, 1925, p. 248; 1933, pp. 423–5 (part). Barnard, 1927, p. 508. Weber and de Beaufort, 1931, p. 174 (part). Borodin, 1932, p. 85. Herre, 1939, p. 327; 1953, pp. 478–9 (part). Smith, 1949, p. 204. Roughley, 1951, p. 48, pl. 16. Munro, 1955, p. 122; 1958, p. 178; 1967, p. 347. Palekar and Bal, 1955, p. 128 (part). Scott, 1959, p. 56. Marshall, 1964, p. 169, pl. 34. Whitley, 1964, p. 43. Grant, 1965, p. 86, fig.; 1972, p. 246, fig. Maclean, 1971, pp. 87–92.

? *Sillago gracilis* Alleyne and Macleay, 1877, p. 279, pl. 6, fig. 2 (Torres Strait, Darnley Island or Hall Sound). Macleay, 1881, p. 202. McCulloch, 1911, p. 60.

TYPES: *Sillago maculata* Quoy and Gaimard. A radiograph of the holotype registered A. 3134 in the Museum National D'Histoire Naturelle, Paris, was forwarded by Dr. M. Blanc. The vertebrate number 14-8-13.

Sillago gracilis Alleyne and Macleay. Two specimens were examined by McCulloch (1911, p. 60) who states 'I am unable to find any specimens marked as the types of *Sillago gracilis*, Alleyne and Macleay, in the Macleay Museum, but there are two small specimens labelled "*Sillago* sp? Torres Straits", which I have no doubt are the types. Through the kindness of Professor Haswell and Professor David, I have been allowed to borrow them for examination. One is a little larger than the other, and from the snout to the end of its broken tail is almost 82 mm long, which is exactly the length of the figure of *S.gracilis*. In other details also, such as the form of the damaged tail and the pronounced shrinkage marks on the head, it agrees perfectly with the figure, though it has lost all trace of the colour markings with the exception of the silvery lateral band. Both differ from the description in the number of fin-rays in the dorsal and anal, there being only one spine and twenty rays in each instead of one, twenty-one as stated'. McCulloch regards *S.gracilis* as a junior synonym of *Sillago maculata*. Stanbury (1969) does not mention *Sillago gracilis* in his list of the type specimens in the Macleay Museum. The coloration as described by Alleyne and Macleay is that of a juvenile *Sillago* species.

OTHER MATERIAL. Queensland (193) QM I12902 (12), Bribie Island; QM I2927, Brisbane River; QM I12763 (90), Brisbane Fish Markets; QM I12692 (17), QM I12697 (11), QM I12701 (40), Deception Bay; WAM P13711–22, WAM P13827–34, QM12928, QM I12701, Moreton Bay, New South Wales (35); USNM 93125, Newcastle; USNM 59933, WAM P15531–9, WAM PO 273–90, Sydney; QM I11629, Wallis Lake.

DIAGNOSIS

A black spot at base of pectoral fin, dark blotches on body; anterolateral extensions of swimbladder recurved posteriorly to reach level of vent.

DESCRIPTION

(Based on 27 examples from New South Wales, and 19 examples from Queensland. SL 140–216 mm).

Dorsal fins XI–XII, 1, 19–21; anal fin II, 19–20 (Table 17). Lateral line scales 71–75 (Table 18). TR, 8–9 above, 9–11 below, 5–6 scales between L. lat. and spinous dorsal origin. Cheek scales in 3–4 rows, cycloid with an occasional few ctenoid scales.

Proportional dimensions as percent of SL (Modal frequency within parentheses): Greatest depth of body 19–23 (21); head length 26–29 (27); snout tip to ventral fin origin 31–35 (32); snout tip to second dorsal fin origin 53–57 (55); snout tip to anal fin origin 56–60 (59); least depth of caudal peduncle 7–8 (8).

Proportional dimensions as percent of head: Length of snout 37–44 (40); horizontal diameter of eye 20–25 (22); least width of interorbital 18–22 (20).

VERTEBRAE: 13–15 abdominal, 8–11 modified, 10–14 caudal; 13–15 + 20–22, total 34–36 (Table 19).

COLOUR IN ALCOHOL: Body light brown to brown, darker above; back and sides with seven to nine irregular dusky blotches directed obliquely forwards in most specimens; a conspicuous median, longitudinal silvery band on sides; lower sides silvery to white; spinous dorsal fin blotched with brown; soft dorsal with three to five rows of brown spots on the membranes; anal fin pale yellow; pectoral fin finely dusted with brown to black spots, and with a brown to black spot on the base.

COLOUR IN LIFE: Body sandy-brown to olive-green above; back and sides with dark brown irregular blotches; longitudinal lateral band silver, to pale golden silver, outlined in pale mauve brown; sides silvery-brown to creamish or white with blue reflections. Head dark olive-brown, greenish, or pale brown above, cheeks and opercles golden-green with a darker blotch on the opercles of some specimens; spinous dorsal whitish, with the membrane mottled with olive-green or brown; soft dorsal with about five rows of brownish-green spots; anal and ventrals golden to yellow with the margins cream; pectoral straw-yellow to pale green-yellow, with a blue-black basal spot, caudal olive brown to dark greenish-brown, with the margin dark brown to black.

SWIMBLADDER: A short anterior median extension and two anterolateral extensions are present; at the base of the anterolateral extensions is a most complex system of tubular canals that anastomose and join the swimbladder at four positions anteriorly; the lateral extensions reach to the duct-like process on the ventral surface; posterior extension of the swimbladder single (Fig. 7B).

GEOGRAPHIC VARIATION

Samples from eastern Australia show no geographic variation. Specimens with 13 abdominal vertebrae are usually quite small in length and the first haemal arch is very narrow and often hairlike.

DISTRIBUTION

East Coast of Australia.

BIOLOGY

Ogilby (1893, pp. 100–2) states that this species spawns during March and April. 'The ova is deposited on sandy beaches in sheltered bays and lakes, and in estuaries, water of no great depth being selected'. Ogilby further describes the behaviour of the fry in shallow water — 'each of these young fish is in possession of a hole in the sand, but whether self-excavated or having been deserted by, or taken from, its rightful owner, we are not in a position to state; at the mouth of the hole, which is only just large enough to admit of the passage of its body, the little creature lies, and on the approach of danger, or even the passage of a dark cloud over the sun, immediately disappears, the anterior half of the head, however, as quickly reappearing, thus showing that close beneath the surface a chamber must exist, sufficiently large to permit of their turning around with ease; should any movement occur in their neighbourhood to cause them further alarm when in this position they are able to back down again into their hiding place with great celerity, but if perfect quiet is maintained, they soon emerge and take up their original position near the opening'.

The food and feeding of this species is reported by Maclean (1971), the diet of juveniles being largely small crustaceans and that of the adult fish mostly polychaete worms.

Sillago maculata maculata is found on silty and muddy substrates, frequenting the mouths of rivers, estuaries and mangrove creeks. Large numbers are seine-netted in the shallows and taken by trawl net in Moreton Bay. Good catches are made by hook and line. The juveniles are most abundant in estuaries and shallow water during the summer months.

REMARKS

S.maculata maculata is one of three subspecies. All subspecies are similar in colouration and morphology, and differ mainly in the shape of the swimbladder and the vertebrae counts.

TABLE 17: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO MACULATA MACULATA*

Dorsal rays	19	19	20	20	20	21
Anal rays	19	20	18	19	20	20
Queensland	1	1	1	78	31	1
New South Wales	5	1	-	12	10	-

TABLE 18: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO MACULATA MACULATA*

Lateral line scales	69	70	71	72	73	74	75
Queensland	5	15	8	20	25	12	5
New South Wales	1	-	2	8	9	1	-

TABLE 19: VERTEBRAE COUNTS OF *SILLAGO MACULATA MACULATA*

Abdominal	13	13	13	13	14	14	14	14	14	14	14	14	15
Precaudal	9	9	10	10	8	8	8	9	9	10	10	11	8
Caudal	12	13	11	12	12	13	14	12	13	11	12	10	12
Queensland	1	3	1	2	1	29	-	82	3	11	3	1	4
New South Wales	-	1	-	1	-	6	1	10	4	-	-	-	-

Sillago (Parasillago) maculata burrus Richardson

Western Trumpeter Whiting
(Figs. 3D, 10B, 14H, 16)

Sillago burrus Richardson, 1842, pp. 128-30. (Northwest Australia); 1843, pt 2, fig. 1. Castelnau, 1878, p. 232.

Sillago maculata burra, Whitley, 1948, p. 19.

Sillago maculata, Paradice and Whitley, 1927, p. 89. Taylor, 1964, pp. 174-5.

MATERIAL EXAMINED

TYPE. *Sillago burrus* Richardson. Based on a drawing by Lieutenant Emery, no type specimen available. The description given by Richardson (1842, pp. 128-30) agrees in all essential details with the subspecies of *S.maculata* from Western Australia, Northern Territory and Gulf of Carpentaria. Richardson states that 'it is banded on the sides like *Sillago maculata* of MM. Quoy and Gaimard, which inhabits Port Jackson, but it wants the silvery lateral stripe, shows spots on the dorsals, and has a higher and more elliptical body than that species'.

I have examined specimens of *Sillago maculata* from Western Australia, Gulf of Carpentaria, Queensland and New South Wales that have the lateral silvery band reduced, inconspicuous or entirely absent. Richardson's species was listed as a synonym of *S.maculata* by Fowler (1933, pp. 424-5) and Taylor (1964, p. 175). Stokes (1846) records the voyage of 'HMS Beagle' during the exploratory surveying of the north-west coast of Australia. Lieutenant Emery departed HMS Beagle in March 1841 for England, and his sketches were used by Richardson as a basis for description of some Australian fishes. Efforts to locate the illustration of *S.burrus* (No. 37 of Emery) were without success. Emery numbered all his sketches and his number 4 is listed as Tale Bay. At the Houtman Abrolhos Islands (April 10, 1840) Stokes (1846, p. 161) wrote 'There were not many varieties of fish, the most abundant being snappers; of those that were rare Lieut. Emery made faithful sketches'. Emery made sketches No. 9 to 17 at the Abrolhos, and at Depuch Island on June 9th, drew sketches 22, 25, 26, 27 and 29. On July 14 'HMS Beagle' anchored at Turtle Island and Bedout Island and then sailed direct for Timor Island, arriving on July 24. The vessel departed Timor on August 6 and arrived at Bedout Island, Dampier Archipelago on August 17. Boats were sent to examine the coast to the southward of Cape Lambert with the neighbouring islands; an extent of almost 45 miles was examined. Extensive areas of mud and sand flats were encountered and between Picard Island and Cape Lambert the shore is cut by mangrove creeks. From Delambre Island the HMS Beagle proceeded to the Montebello Islands, anchoring on the eastern side of Tremouille Island on August 31st. Anchorage was next made at Barrow Island where Lieut. Emery made sketch number 42. Drawings numbered 36, 37, 38 were recorded by Richardson (1842) as north-west coast of Australia, and sketch number 42 as Barrow Island (Richardson 1843, Icones Piscium, pl. iii, fig. 2). The area of capture of *Sillago burrus* is therefore between Depuch Island and Barrow Island. Timor is also a possibility but almost certainly would have been mentioned by Emery.

Specimens were unavailable to Richardson and the description is based on sketch 37 by Lieut. Emery, the original of which has apparently been lost (Fig. 3D). Allen (1972, p. 95) has erected a neotype of *Amphiprion rubrocinctus* Richardson, 1842; I follow his example by herewith designating CSIRO C2591, 140 mm in standard length, collected at Dampier Archipelago, Western Australia as the neotype of *Sillago burrus* Richardson, 1842.

OTHER MATERIAL: Western Australia (110); WAM PO 618, WAM PO 751, Admiralty Gulf; WAM P14863, WAM PO 325-9, Canning River; CSIRO C2641, WAM PO 867-935, Cockburn Sound; CSIRO C2591, C2643, Dampier Archipelago; CSIRO C2457-8, WAM PO 330-4, Exmouth Gulf; AMNH 4770, Mandurah; WAM PO 466-8, Nichol Bay; CSIRO C2369, Rockingham; CSIRO C2318, WAM P13224-35, WAM P14142-50, WAM P14176, WAM P14535-9, WAM P14984-98, WAM P15129-40, WAM P15222-30, WAM P15247-58, WAM PO 160-7, WAM PO 180-4, WAM PO 971-3, Shark Bay; WAM PO 749, WAM PO 754-7, Swan River; Northern Territory (46); WAM P14433, WAM P14493-506, Darwin; USNM 174058-60, Groote Eylandt; USNM 174064, Port Bradshaw; USNM 174061, Port Longdon; QM I13162 (3), QM I13155 (18), QM I13166, Shoal Bay, Queensland (22); CSIRO A 1222, Gilbert River; WAM P12810, AM I15537-60, Gulf of Carpentaria, New Guinea (3); QM I13214, Dam Island, Indonesia (3) Bernice P. Bishop Museum 19453, Ambon, Molucca Islands.

DIAGNOSIS

Similar to *Sillago maculata aeolus* in colouration but with 34 to 36 (rarely 34) vertebrae (13–14 abdominal, 20–22 caudal); usually 19–20 anal rays (rarely 18). The swimbladder has four anterolateral extensions that are more complex than *S.maculata aeolus*, but much shorter than *S.maculata maculata*.

DESCRIPTION

(Based on the neotype, 29 specimens from Shark Bay, W.A., and 14 specimens from Darwin, Northern Territory).

Dorsal fins XI, I, 19–21; anal fin II, 18–20 (Table 20). Lateral line scales 69 to 76 (Table 21). TR 8–10 above, 9–11 below, 5–6 scales between L. lat. and spinous dorsal origin. Cheek scales in 2–3 rows, all cycloid.

Proportional dimensions as percent of SL (modal frequency within parentheses):

Greatest depth of body 20–23 (21); head length 26–31 (29); snout tip to ventral fin origin 28–33 (30); snout tip to spinous dorsal fin origin 30–35 (34); snout tip to second dorsal fin origin 54–58 (55); snout tip to anal fin origin 55–60 (57); least depth of caudal peduncle 7–9 (8).

Proportional dimensions as percent of head: Length of snout 39–45 (41) Shark Bay, 36–41 (39) Darwin; horizontal diameter of eye 19–25 (22); least width of interorbital 17–21 (19) Shark Bay, 17–20 (18) Darwin.

VERTEBRAE: 13–14 abdominal, 7–11 modified, 11–14 caudal total 34–36 (Table 22).

COLOUR IN ALCOHOL: Body light sandy brown to brown, darker above; sides with nine to eleven dusky brown spots situated on a silvery mid-lateral stripe; above which and situated almost between the lateral spots are ten to eleven oblique blotches that widen ventrally; lower sides paler, breast and mid-line of belly silver; spinous dorsal fin blotched with brown in one to three vague bands; soft dorsal with three to four dark spots on membrane forming longitudinal lines; anal fin hyaline; pectoral fin hyaline, the base silvery with an overlay of purple brown to blackish pigment; caudal with the upper and lower margin finely spotted.

In colouration *S.maculata burrus* is very similar to *S.maculata maculata* but in the latter species the upper and lower blotches are frequently joined, at least posteriorly; the upper blotches are generally larger; the black spot at the base of the pectoral fin is more distinct; the belly is not silver, and the opercle is dull or with the inner dark blotch showing through (inside of opercle of *S.maculata burrus* is white). The lateral silvery stripe is usually more noticeable in the western subspecies but may be quite faded. The eastern subspecies frequently has the upper and lower margins of the caudal fin very dark brown to black. The abdominal walls of the western subspecies is usually white or silvery whereas they are pale flesh coloured in the eastern subspecies. Some of the colour differences between Arnhem Land specimens and those from New South Wales had been noted by Taylor (1964, p. 175). Whitley (1948, p. 19) used *S.maculata burra* for the western population but gave no reasons for doing so and later abandoned the subspecific distinction (Whitley, 1964, p. 43).

SWIMBLADDER: A short anterior median extension and four anterolateral rudimentary extensions, the first two continuous, the posterior ones less well developed and normally separate; a duct like process on the ventral surface is present and the posterior extension is single. The lateral extensions are very much reduced in size to those of the eastern subspecies *S.maculata maculata*, and resemble the rudimentary ones of *S.maculata aeolus* with the exception that four openings occur into anterolateral extensions of *S.maculata*

burrus, the extensions are more complex, and the first two are continuous (Fig. 10B).

Geographic Variation

Little variation between samples was noticed, however, the length of the snout and the width of the interorbital space was slightly greater in the Shark Bay samples than those from Darwin.

Distribution

Western and northern coast of Australia, southern New Guinea, and Indonesia.

Biology

The western trumpeter whiting appears to be similar in many respects to the eastern subspecies. The western subspecies is most abundant on silty-sand or muddy substrates, the large adults feeding near gutters and sandbars inside Shark Bay and may be found on quite sandy bottoms. The juveniles frequent seaweed banks and broken bottom, and occur in large numbers near mangrove creeks. The juveniles and adults are commonly trawled in association with the western population of *Sillago robusta*, and *Sillago lutea* in depths to 20 fathoms.

Juveniles enter the coastal rivers and in the Swan and Mandurah estuaries in Western Australia the juveniles may be common throughout the summer months when they are netted by prawn fishermen operating in shallow weedy areas. Offshore on the lower west coast of Western Australia *Sillago vittata* is commonly trawled with *Sillago bassensis bassensis* on sand substrates. *Sillago maculata burrus* is only occasionally taken in association with the latter species, but becomes much more abundant further northwards. Inside Shark Bay the western trumpeter whiting may be associated in shallow onshore waters with *Sillago analis*, *Sillago schomburgkii* and *Sillago vittata*.

Remarks

It is postulated that Torres Straits, during the last glaciation, became a land barrier isolating the eastern and western populations of *Sillago maculata*.

TABLE 20: Frequency Distributions of Dorsal and Anal Fin Rays of *Sillago maculata burrus*

Dorsal rays	19	19	20	20	20	21	21
Anal rays	18	19	18	19	20	19	20
Western Australia	3	7	6	75	2	1	–
Northern Territory	–	–	–	44	1	–	1
Gulf of Carpentaria	–	–	–	4	–	–	–
New Guinea	–	1	–	2	–	–	–
Indonesia	–	–	–	2	–	–	1

TABLE 21: Frequency Distributions of Lateral Line Scales of *Sillago maculata burrus*

Lateral line scales	69	70	71	72	73	74	75	76
Western Australia	–	–	6	12	25	7	6	2
Northern Territory	1	7	9	9	4	4	–	–
Gulf of Carpentaria	–	–	–	1	4	–	–	–
New Guinea	–	–	–	2	1	–	–	–
Indonesia	–	–	2	–	1	–	–	–

TABLE 22: Vertebrae Counts of *Sillago maculata burrus*

Abdominal	13	13	13	14	14	14	14	14	14	14	14	14
Modified	9	9	11	7	8	8	8	9	9	9	10	10
Caudal	12	13	11	14	12	13	14	11	12	13	11	12
Western Australia	1	1	1	–	3	19	1	1	60	–	18	1
Northern Territory	–	–	–	1	–	–	–	–	–	–	–	–
New Guinea	–	–	–	1	1	–	–	–	–	1	–	–

Sillago (Parasillago) maculata aeolus Jordan and Evermann

Oriental Trumpeter Whiting
(Figs. 3E, 10A, 13Q, 14I, 16)

Sillago aeolus Jordan and Evermann, 1902, p. 360, fig. 24 (Keerun, Formosa). Jordan and Richardson, 1909, p. 192.

Sillago macrolepis: Evermann and Seale, 1907, p. 187 (non*Sillago macrolepis* Bleeker).

Sillago maculata: Kner, 1865, p. 127. Bleeker, 1874, p. 71 (part). Pellegrin, 1905, p. 83. Seale, 1914, p. 69. Weber and de Beaufort, 1931, p. 174 (part). Fowler, 1933, pp. 423–5 (part); 1935, p. 150; 1937, p. 238; 1949, p. 52. Martin and Montalban, 1934, pp. 224–5, pl. 1, fig. 2. Suvatti, 1950, p. 394. Herre, 1953, pp. 478–9 (part). Palekar and Bal, 1955, p. 128 (part). Shao and Chang, 1978, p. 5; 1979, pp. 695–705, Dutt and Sujatha, 1980, p. 372. McKay, 1980, pp. 383–4.

MATERIAL EXAMINED

TYPE: *Sillago aeolus* Jordan and Evermann. A radiograph of the holotype registered No. 7135 in the Stanford University. The vertebrae count is 14–5–15.

OTHER MATERIAL: Singapore (2), QM 112884, Changi Beach; Thailand (15); CAS 14160 Ban Paknam Prasae; QM 112915, Chantaburi, CAS 14161, CAS 14166, Chol Buri; CAS 14168, Ban Pae, Royong Province; CAS 14163 Goh Samed, Chumphon Province; CAS 14194 Lem Saplee, Chumphon Province; CAS 14171 Sattahip Bay, Rayong Province. China (1); USNM 148381 Shanghai, Hong Kong (3); USNM 5891, BM 1939.2.23.51, no locality. Taiwan (6); USNM 192874–5 Ma-Kung Market, Peng-Hu Hsien, WAM PO472, THUP 00983, Taichung. Philippines (188); Cebu, USNM 145081 Cebu Market, Panay, USNM 102498, USNM 102501, USNM 102549, USNM 102582, USNM 102683, USNM 106797–8, USNM 106800, USNM 10683–4, USNM 106806–10, USNM 106812–3, USNM 112831, Iloilo; USNM 56215, Bulan; Samar, USNM 145076, Cavite.

DIAGNOSIS

Very similar to *Sillago maculata burrus* in colouration but has the most posterior mid-lateral dark brown blotch elongate and reaching caudal flexure; swimbladder with three rudimentary anterolateral extensions instead of four. Differs from *Sillago maculata maculata* in lacking well developed anterolateral extensions reaching to level of vent.

DESCRIPTION

(Based on 27 examples: China 1, Hong Kong 2, Philippine Islands 10, Taiwan 4 and Thailand 10).

Dorsal fins XI, 1, 18–20; anal fin II, 17–19 (Table 23). Lateral line scales 67–72 (Table 24). TR. 8 above, 9–10 below, 5–6 scales between L. lat. and spinous dorsal origin. Cheek scales in 3–4 rows, all cycloid.

Proportional dimensions as percent of SL (modal frequency within parentheses): Greatest depth of body 20–22 (21); head length 27–31 (28); snout tip to ventral fin origin 30–33 (31); snout tip to spinous dorsal fin origin 30–35 (33); snout tip to second dorsal fin origin 54–58 (57); snout tip to anal fin origin 57–61 (60); least depth of caudal peduncle 7–8 (8).

Proportional dimensions as percent of head: Length of snout 36–40 (38); horizontal diameter of eye 20–26 (26); least width of interorbital 18–20 (19).

VERTEBRAE: 13–14 abdominal, 4–7 modified, 14–16 caudal; 14+20, total 34 (Table 25).

COLOUR IN ALCOHOL: Body light brown, slightly darker above, with two longitudinal rows of elongate short dark brown bars; the anterior bars inclined, especially above the lateral line; the posterior bars slightly inclined above; but generally horizontal below the lateral line; spinous dorsal fin finely speckled with black, especially the outer part of the membrane; soft dorsal with two longitudinal brown bands on the membranes; anal fin hyaline; pectoral fin with a conspicuous dark brown to black bar or spot across the base; upper part of head brown. The colouration of this subspecies greatly resembles *Sillago maculata burrus* in having the posterior dark bars separate from the mid-lateral blotches in almost all specimens but differs in having more elongate mid-lateral blotches, lacks the silvery belly, and generally has a less distinct silvery mid-lateral stripe; the abdominal walls are flesh coloured not silvery; the most posterior mid-lateral dark brown blotch is elongate and reaches the caudal flexure, whereas in *S. maculata burrus* there are normally two almost round blotches, one on each side of the caudal flexure.

SWIMBLADDER: An anterior median extension to the basioccipital is present and well developed; three rudimentary and often convoluted extensions are present on the anterolateral surface; a duct-like process present; posterior extension single and tapering (Fig. 10A).

GEOGRAPHIC VARIATION

None found throughout the known range of the subspecies.

DISTRIBUTION

Singapore, Thailand, China, Hong Kong, Taiwan and Philippines. Possibly distributed throughout the Indo-West Pacific from South

Africa to China and Philippines, but not recorded from Australia or southern New Guinea.

BIOLOGY

Little known. Maxwell (1921) records juveniles burrowing in the sand. Attains approximately 30 cm.

REMARKS

Sillago maculata aeolus is the northern representative of *S. maculata maculata*.

TABLE 23: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO MACULATA AEOLUS*

Dorsal rays	18	18	19	19	19	20
Anal rays	17	18	17	18	19	18
Singapore	–	–	–	1	–	1
Thailand	–	2	4	11	1	–
China	–	–	–	–	–	1
Hong Kong	–	–	–	2	–	–
Taiwan	1	–	–	4	–	1
Philippines	1	–	1	25	–	–

TABLE 24: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO MACULATA AEOLUS*

Lateral line scales	67	68	69	70	71
Singapore	–	–	2	–	–
Thailand	–	3	8	–	–
China	–	–	–	1	–
Hong Kong	1	–	–	1	–
Taiwan	–	1	1	1	1
Philippines	–	6	3	1	–

TABLE 25: VERTEBRAE OF *SILLAGO MACULATA AEOLUS*

Abdominal	14	14	14	13	13
Modified	4	5	6	6	7
Caudal	16	15	14	15	14
Singapore	–	–	–	1	1
Thailand	1	4	2	–	–
China	–	–	1	–	–
Hong Kong	–	1	1	–	–
Taiwan	2	2	–	2	–
Philippines	–	6	6	–	–

Sillago (Parasillago) bassensis bassensis Cuvier

Western School Whiting
(Figs. 4A, 13U–V, 14J, 15)

Sillago bassensis Cuvier, *in* Cuvier and Valenciennes, 1829, p. 412 (Port Western, Bass Strait, Victoria). Quoy and Gaimard, 1834, pp. 672–3, pl. 1, fig. 2. McCulloch, 1911, p. 61 (part). Fowler, 1933, pp. 422–3 (part). Whitley, 1948, p. 19; 1964, p. 43. Roughley, 1951, pp. 48–49 (part). Scott, 1962, p. 187.

MATERIAL EXAMINED

TYPES: A radiograph of the holotype, registered A3135 in the Museum National D'Histoire Naturelle, Paris, was forwarded by Dr M. Blanc, the vertebrae number 13–13–8. Cuvier (1829, p. 412) give the type locality as 'Port Western in Bass Strait' but the holotype has the locality recorded as 'Port du Roi Georges' 'Quoy et Gaimard'. I have followed Cuvier and have recorded the type locality as Western Port.

OTHER MATERIAL: Western Australia (79); WAM P14756, Lancelin Island; CSIRO C2626, Cottesloe, WAM P12881–5, South Fremantle; WAM P14348–80, WAM P14476–8, WAM PO 1–2, WAM PO 31–45, WAM PO56–7, north-east of Rottnest Island; CSIRO C1433 south-west of Western Australia; WAM PO810–21, Denmark; WAM P12698, Albany; WAM PO 763–5, Cheyne Beach; CSIRO C1935 Starvation Boat Harbour. South Australia (49); WAM PO 291–302, Streaky Bay; WAM PO 205–24, Coffin Bay; WAM P15352, Port Clinton; WAM PO 240–5, Adelaide Market; WAM PO 304–13 Port Noarlunga.

DIAGNOSIS

Dorsal fins X–XII, 1, 18–19; anal fin II, 18–20; lateral line scales 66–73; no dark spot at the base of the pectoral fin; a series of oblique broken rusty-brown stripes on the back and upper sides, without a longitudinal row of rusty-brown blotches along the mid-lateral silver stripe. Vertebrae 12–14 abdominal, 12–14 modified, 7–9 caudal, total 33–35.

DESCRIPTION

Dorsal fins X–XII, 1, 18–19; anal fin II, 18–20; (Table 26). Lateral line scales 66–73 (Table 27). TR. 5–6 above, 10–14 below, 5–6 (usually 5) scales between L. lat. and spinous dorsal fin origin. Cheek scales in 3–4 rows, all ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 20–24; head length 26–30; snout tip to ventral fin origin 28–33; snout tip to spinous dorsal fin origin 32–35; snout tip to second dorsal fin origin 53–57; snout tip to anal fin origin 53–57; least depth of caudal peduncle 7–8.

Proportional dimensions as percent of head: Length of snout 39–44; horizontal diameter of eye 19–26; least width of interorbital 17–21.

VERTEBRAE: 12–14 abdominal, 12–14 modified, 7–9 caudal; 12–14 + 20–22, total 33–35 (see Table 28).

COLOUR IN ALCOHOL: Body creamy-brown to rusty-brown above, silvery-white below, the two colours sharply separated by a silvery mid-lateral band with a narrow rusty-brown longitudinal

narrow stripe above; back and upper sides with irregular red-brown to rusty-brown oblique, broken, or wavy stripes, and narrow blotches, vaguely resembling those of *Sillago maculata* ; dorsal fins with rows of rusty-brown or reddish-orange spots; anal fin yellowish or hyaline; other fins pale cream, white,or hyaline. No black blotch on the base of the pectoral fin.

COLOUR IN LIFE: Body cream-brown, sandy-pink or pale rust-brown, the head, cheeks and sides of the body with mauve, blue and pink reflections; mid-lateral band silver; belly pink or white; back and upper sides with oblique irregular orange-brown or rust coloured narrow stripes, sometimes broken into groups of oblique dots or blotches. Fins as described above. No rust-brown blotches mid-laterally.

SWIMBLADDER: A short blunt anterior median projection is present, and a single long tapering caudal extension is well developed. A duct-like process from the ventral surface to the urogenital aperture is present. I find no appreciable differences in the swimbladder of the eastern and western populations (fig. 9I–L).

GEOGRAPHIC VARIATION

The Western Australian and South Australian specimens show no differences in colouration, fin rays counts, or vertebrae counts.

DISTRIBUTION

Geraldton area Western Australia southwards and along the southern coast to South Australia and western Victoria; not yet recorded from western Tasmania.

BIOLOGY

A very common whiting along the lower Western Australian coastline, and bays of South Australia. Frequenting the surf zone of beaches and quiet waters of bays and sandbanks, this subspecies is also trawled in offshore waters to at least 23 fathoms and possibly much deeper. Juveniles may be found in a few inches of water off white sand beaches, but are not recorded from estuarine waters as are the juveniles of *Sillaginodes punctata*, *Sillago schomburgkii*, and *Sillago maculata burrus*.

The western School Whiting is reported to move into shallow waters in large schools during the full moon. Maximum size attained is about 33 cm.

REMARKS

Sillago bassensis is the only whiting species with a southern distribution that is known from eastern and western Australia. Unconfirmed reports of *Sillaginodes punctata* from southern New South Wales and Lakes Entrance, Victoria, have been made, but all specimens identified were *S. bassensis flindersi*.

Previous authors (Munro 1949; Malcolm 1959; Collette 1974) have shown that subspeciation on each side of Bass Strait has occurred in the few fishes that have been critically examined. *S. bassensis* is yet another such species and it suggests that Bass Strait, during glacial periods was a barrier subdividing previously continuous species into separate populations for sufficient time for at least subspeciation to occur. The differences between such subspecies may well appear to be minor ones, nevertheless they are constant and of a greater magnitude than those between *S. analis* and *S. ciliata* which must be regarded as valid species. Further collecting in the Bass Strait area may show the *S. bassensis* subspecies to be valid species.

Sillago (Parasillago) bassensis flindersi new subspecies

Eastern School Whiting
(Figs. 9I–L, 14K, 15)

Sillago bassensis: Cohen, 1892, p. 17. Stead, 1906a, pp. 574–6; 1906b, p. 111; 1908b, p. 65, pl. 35. McCulloch, 1911, p. 61 (part); 1921, p. 61, pl. 21. Fowler, 1933, pp. 422–3 (part). Roughley, 1951, pp. 48–9 (part). Parrott, 1959, p. 201. Scott, 1962, p. 187. Marshall, 1964, p. 170. Whitley, 1964, p. 43. Grant, 1965, p. 87; 1972, p. 247.

Sillago maculata: Castelnau, 1872, p. 94. Waite, 1899, p. 109 (non *Sillago maculata* Quoy and Gaimard).

Sillago ciliata: Johnston, 1883, pp. 80, 116; 1890, pp. 25, 33 (non *Sillago ciliata* Cuvier).

MATERIAL EXAMINED

TYPES: Holotype, SL 195mm, collected by J.R. Paxton, W. Smith-Vaniz and R.J. McKay, Sydney Fish Markets, consigned from Wallis Lake, New South Wales, trawled, registered QM I13252 in Queensland Museum.

PARATYPES: Queensland (19); WAM PO366–85, Moreton Bay, New South Wales (51); QM I11109 (4), Ballina; CSIRO C3523, Coogee; CSIRO C3522, Lake Macquarie; CSIRO C3520, C3524, Port Jackson; AM IB1666–8 Pittwater; AM IB5119, Port Stephens; AM I9575–7, near Sydney; QM I11630 (35), Wallis Lake. AM I7657, USNM 59939, New South Wales. Victoria (6); WAM PO793–7, WAM P19116, Lakes Entrance Tasmania (95); AM I10001, east coast Flinders Island; QM I12311, QM I12695 (91) Swansea; CSIRO C3521, AM B5569, Tasmania.

DIAGNOSIS

Dorsal fins XI, 1, 16–18; anal fin II, 18–20; lateral line scales 65–69; no dark spot at the base

of the pectoral fin; a series of oblique rusty-brown stripes on back and upper sides, with a longitudinal row of rusty-brown blotches along the mid-lateral silver stripe. Vertebrae 13 abdominal, 9–11 modified, 9–11 caudal, total 32–34.

DESCRIPTION

Dorsal fins XI, 1, 16–18; anal fin II, 18–20 (Table 26). Lateral line scales 65–69 (Table 27). TR. 5 above, 10 below. Cheek scales in 3 rows, ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 20–23; head length 25–30; snout tip to ventral fin origin 27–33; snout tip to spinous dorsal fin origin 33–36; snout tip to second dorsal fin origin 55–57; snout tip to anal fin origin 54–57; least depth of caudal peduncle 7–8.

Proportional dimensions as percent of head: Length of snout 36–41; horizontal diameter of eye 20–25; least width of interorbital 18–21.

VERTEBRAE: 137 specimens, 13 abdominal, 9–11 modified, 9–11 caudal, 13 + 19–21, total 32–34 (see Table 28).

COLOUR IN ALCOHOL: Body pale sandy-pink to pale brown above, silvery white below, the two colours separated by a silvery lateral band with a longitudinal row of pale rust-brown blotches; back and upper sides with fairly regular brownish oblique stripes almost a scale diameter in width.

COLOUR IN LIFE: Body pale sandy-brown to pink with posteriorly directed oblique broken and unbroken bands of rust-red to bright orange-brown above the lateral line to the base of the dorsal fins; a series of about a dozen similarly coloured blotches situated just above a conspicuous silvery lateral band. Head olive-brown to pink with tinges of pale blue and yellow; opercle silvery with a few scattered blotches of rust-red. Pectoral base and axilla dull yellow. Spinous dorsal fin hyaline with scattered rust-red spots; rayed dorsal fin with membrane hyaline and rays with 4 to 5 red-brown spots. Anal fin with membrane hyaline and rays yellow-orange with white margin. Ventral fin milk white or hyaline, the membrane between the spine and the first ray white, remainder of rays yellow with white tips. Belly pale silvery-white with blue and yellow reflections, the breast and undersurface of head frequently dusted with fine black spots. Colouration is very similar to *S. bassensis bassensis* but the oblique stripes are wider, more regular and without the appearance of fused dots or spots; the mid-lateral blotches are absent in the western subspecies.

SWIMBLADDER: See *Sillago bassensis bassensis.*

GEOGRAPHIC VARIATION

No geographic variation was found between the samples from Queensland, New South Wales, Victoria and eastern Tasmania.

DISTRIBUTION

Southern Queensland southwards to eastern Victoria and the east coast of Tasmania.

BIOLOGY

This species is not well known in eastern Australia and was, until recent years, almost neglected. It was unknown in southern Queensland until the development of offshore prawn trawling (Grant 1965). A commercial trawl fishery has commenced in New South Wales and Victoria, where the subspecies is commonly referred to as 'spotted whiting'. Large catches may be made in shallow water just off the beach at Lakes Entrance (J.R. Paxton pers. comm.) otherwise the eastern subspecies is a deeper water inhabitant and has been recorded to a depth of 84 fathoms (Waite, 1899, p. 109 as '*S. maculata*'). The deep water trawl females are normally in full roe suggesting that the species spawns well offshore along most of the coast but may congregate around the vicinity of coastal lakes in New South Wales and Victoria; the juveniles have been found inshore.

Stead (1906a) correctly identified *S. bassensis* and described the colouration of the eastern subspecies. From his observations it seems that *S. bassensis flindersi* at certain times of the year, particularly from January to March, is found in considerable numbers at the entrance to Port Jackson, and is captured in abundance by means of hook and line, being familiarly known to boys as 'School Whiting'.

Maximum size attained is approximately 32 cm.

REMARKS

See *Sillago bassensis bassensis.*

DERIVATION

Named in honour of Lieutenant Matthew Flinders 1774–1814 who circumnavigated Australia.

Sillago (Parasillago) robusta Stead

Stout Whiting

(Figs. 4C, 11D–J, 13R–T, 14M–N, 18).

Sillago robusta Stead, 1908, p. 7 (Rose Bay, Port Jackson, New South Wales). McCulloch, 1921, p. 61. Marshall, 1964, p. 170. Whitley, 1964, p. 43. Grant, 1965, p. 87; 1972, p. 247, fig.

TABLE 26: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO BASSENSIS BASSENSIS** AND *SILLAGO BASSENSIS FLINDERSI*+

Dorsal rays	16	16	17	17	17	18	18	18	19	19
Anal rays	19	18	18	19	20	18	19	20	18	19
*Western Australia	–	–	–	–	–	1	38	4	1	1
*South Australia	–	–	–	–	–	6	25	1	1	6
+Victoria	1	–	–	3	–	–	–	–	–	–
+Tasmania	4	3	22	60	3	–	1	2	–	–
+New South Wales	–	–	5	38	1	–	1	1	–	–
+Queensland	–	–	2	15	3	–	–	–	–	–

TABLE 27: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO BASSENSIS BASSENSIS** AND *SILLAGO BASSENSIS FLINDERSI*+

Lateral Line Scales	65	66	67	68	69	70	71	72	73
*Western Australia	–	1	–	3	11	10	10	3	4
*South Australia	–	1	1	3	4	8	6	2	1
+Victoria	1	2	1	–	–	–	–	–	–
+Tasmania	4	10	28	9	1	–	–	–	–
+New South Wales	1	9	18	14	4	–	–	–	–
+Queensland	–	–	3	–	–	–	–	–	–

TABLE 28: VERTEBRAE OF *SILLAGO BASSENSIS BASSENSIS** AND *SILLAGO BASSENSIS FLINDERSI*+

Abdominal	13	13	13	13	13	13	13	13	13	13	13	13	12	12	14	14
Modified	9	10	10	9	10	11	11	12	12	13	13	14	13	14	12	13
Caudal	10	9	11	11	10	9	10	8	9	8	9	7	9	8	8	7
*Western Australia	–	–	–	–	–	–	–	1	20	16	3	1	1	2	–	–
*South Australia	–	–	–	–	–	–	–	–	8	30	1	4	–	1	1	2
+Victoria	–	–	–	–	3	2	–	–	–	–	–	–	–	–	–	–
+Tasmania	–	–	4	17	45	2	2	–	–	–	–	–	–	–	–	–
+New South Wales	–	1	1	5	26	9	–	–	–	–	–	–	–	–	–	–
+Queensland	1	–	–	1	12	6	–	–	–	–	–	–	–	–	–	–

Sillago auricomis Ogilby, 1910, pp. 97-8 (Between Moreton Island and Hervey Bay). Whitley, 1932, p. 344. Ladiges, Von Wahlert, and Mohr, 1958, pp. 164-5.

MATERIAL EXAMINED

TYPES. *Sillago robusta* Stead. Not examined. The location of the holotype is unknown.

Sillago auricomis Ogilby. A photograph of a syntype registered 13.406 in the Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, was kindly provided by Dr W. Ladiges, and leaves no doubt that *S. auricomis* is a junior synonym of *S. robusta*.

OTHER MATERIAL: Western Australia (254); WAM PO 936-59, Lat. 17°26'S. Long. 121°54'E; CSIRO A1284, Exmouth Gulf, WAM PO 936-59 Pt. Coulomb; WAM PO 46-55, WAM PO 107-131, WAM P13236-9, WAM P13245-51, WAM P13994-14000, WAM P14543-50, WAM P14577, WAM P15051-70, WAM P15079-92, WAM P15113-27, WAM P15141-192, WAM P15231-41, WAM P15354-68, Shark Bay; WAM PO 6-7, WAM P14177-8, WAM P14338-47, north-east of Rottnest Island; CSIRO C2627-8, Cottesloe, near Fremantle. Northern Territory (10); WAM P14450-55, WAM P14484-87, 50-56 miles south-west of Darwin. Queensland (27); WAM PO 462-3, QM 112903 (7), Bribie Island; QM 19956, QM 19988, Point Cartwright; QM 12971, QM 1504-5, Double Island Point; CSIRO A1042, A1043, A1038, A1041, off Point Lookout, Stradbroke Island; QM 112735 (3), WAM PO 459, Moreton Bay; QM 112902-3, South Head, Bowen; WAM P14540-2, near Tweed Heads, AM 115557-186, Gulf of Carpentaria. New South Wales (28); QM 17758, Ballina; CSIRO A1634, Botany Bay; CSIRO C3478, Botany Heads; CSIRO C1959 Eden, Twofold Bay; AM IB2542 Evans Head; AM IB1126 Jervis Bay; QM 12973, Manning Head; QM 12972 Shoalhaven Bight; QM 111631 (20) Wallis Lake.

DIAGNOSIS

A small species taken by trawl net. Dorsal rays 16–18, anal rays 16–19, lateral line scales 64–70; 13 abdominal, 20 caudal vertebrae, total 33. First

dorsal spine of large specimens with a sharply keeled anterior edge; the base yellow and remainder of keel dark brown to blackish.

DESCRIPTION

(Based on 36 examples from Western Australia. SL 100–166mm).

Dorsal fins XI, I, 16–18; anal fin II, 16–18 (Table 29). Lateral line scales 65–70 (Table 30); TR. 9–12 above, 10–12 below, 5–6 (usually 5) scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2–3 rows, all ctenoid.

Proportional dimensions as percent of SL (modal frequency within parentheses): Greatest depth of body 18–22 (20); head length 27–30 (28); snout tip to ventral fin origin 28–32 (31); snout tip to spinous dorsal fin origin 31–36 (32–33); snout tip to second dorsal fin origin 55–59 (57); snout tip to anal fin origin 55–60 (58); least depth of caudal peduncle 7–9 (8).

Proportional dimensions as percent of head: Length of snout 35–43 (38); horizontal diameter of eye 22–26 (23–24); least width of interorbital 18–21 (20).

VERTEBRAE: Western population 13+9–12+8–11, 13 abdominal, 20 caudal, total 33; eastern population 13+5–11+9–15 (Table 31).

COLOUR IN ALCOHOL: Body creamy-yellow to sandy-white, white below, with a silvery-white mid-lateral band; head sometimes with a darker line below the suborbital shelf; fins without markings, no dark spot at pectoral base. A small dark spot is usually present just above the base of the first dorsal fin spine.

COLOUR IN LIFE: Body creamy-yellow to pale sandy pink above, silvery-white with reflections of blue and mauve below, the two colours sharply separated by a silvery mid-lateral band that may be ill-defined in some specimens; head with a yellow blotch on the cheeks, body and fins generally without markings; a small lemon-yellow to bright yellow spot on the base of the first dorsal spine, above which is frequently a dark spot or blotch on the keel. Specimens from Shark Bay, Western Australia have the following colouration: Dorsal surface of the body pale lemon-yellow, with a faint mid-lateral silver band; some very faint pale gold stripes directed forwards at an angle of 50° above the mid-lateral band; cheeks yellowish with a darker mark and a faint yellow spot on the upper margin of the operculum; spinous dorsal fin lemon, the base hyaline, a faint dusting of black spots on the upper margin, and a bright yellow spot at the origin with two more yellow spots on the first two spines; soft dorsal with the outer half lemon and finely dusted with black; anal pale-whitish or hyaline; pectoral with the upper half bright orange to yellow, finely dusted with black, and with the inner surface of the base having a bright yellow spot in some specimens; caudal with the margin and outer rays lemon, dusted with black.

Specimens from Wallis Lake, New South Wales have the body coloured pale translucent sandy-brown to pink with blue reflections on scales; a silvery mid-lateral band is present in all specimens. Head pale-brownish above, finely dusted with dark brown; cheeks with a bright blue to mauve stripe under the eye, below which is an area of bright lemon-yellow; preopercle with blue reflections; opercle generally bluish, a darker steel blue spot just below opercular spine and a bright lemon spot more ventrally; eye with the dorsal part of the iris purple-blue, the remainder of the iris silver with yellow blotches. Belly pale silvery to white with blue and pink reflections. Dorsal fin with the base of the first spine white, the remainder of the spine black; upper part of spinous dorsal dark speckled, the lower one third of the membraneous portion of the fin with a bright yellow horizontal band; second dorsal fin with a bright lemon to yellow horizontal band situated about one third the height of the fin. Anal fin with the rays and margin white, the base yellow. Pelvic fins pale white to hyaline. Pectoral fin hyaline, the base with blue reflections and the axilla bright orange-yellow or lemon-yellow. Caudal fin pale lemon with a darker speckled margin.

SWIMBLADDER. The Western Australian specimens have a fairly simple swimbladder that differs from Queensland and New South Wales material in lacking anterolateral extensions; the two populations appear to have quite constant swimbladder differences. The posterior extension is single, a duct-like process from the ventral surface to the urogenital aperture is present.

GEOGRAPHIC VARIATION

This species can be divided into two distinct populations, one on the eastern coast of Australia and one along the western and northern coasts to the Gulf of Carpentaria. The shape of the swimbladder differs slightly (Fig. 11D–J) the development of the first dorsal spine keel in the eastern populations is quite pronounced but only very slightly so in the western population; the posterior third of the modified caudal vertebrae completely surround the posterior extension of the swimbladder in the eastern population, but remain open ventrally in the western population; the shape of the suborbital shelf differs (Fig.

13R–T). Additional specimens are required from the northern coast of Australia to determine the distribution of both populations, and a full osteological comparison is necessary before a subspecific name is provided for the western population. Both populations are structurally very similar and show obvious relationships, especially in colouration.

DISTRIBUTION

Endemic to Australian waters from Fremantle northwards along the northwestern and northern coasts to the Gulf of Carpentaria (western population), and from eastern Queensland and New South Wales (eastern population).

BIOLOGY

Sillago robusta is an offshore species inhabiting sandy substrates. Inside Shark Bay, Western Australia, and Moreton Bay, Queensland, the species is quite common and is usually associated with *Sillago maculata* subspecies. In more northern areas in sandy-mud or turbid silty areas, *Sillago lutea* sp. nov. is the habitat equivalent. Inside Exmouth Gulf, W.A., *Sillago lutea* is very abundant on the mud or mud-sand substrates but is not found south of Shark Bay where clearer water is found, or north off Point Coulomb (17°26'0", 121°54'8") in 28 metres on silty-sand bottom. *Sillago robusta* attains sexual maturity below SL 13cm and rarely exceeds 17cm SL in Western Australia, although the species has been recorded to 28cm in length by trawling vessels working in depths of 35 fathoms off southern Queensland (Grant 1965).

REMARKS

Sillago auricomis Ogilby is clearly referable to *S. robusta* on the basis of the original description. Ogilby, in unpublished notes on *S. auricomis* lists the species with '? *S. robusta* ' alongside and notes that the species is in 'water of a moderate depth (11 to 33 fath.) with a sandy bottom; not found inshore'.

The specimen from the Gulf of Carpentaria (AM I15557–186), 16°40'S, 140°53'E; trawled in 7 fathoms, is clearly of the Shark Bay, Point Coulomb, Darwin population, and not of the eastern Queensland population; the isolating mechanism is thus in the Torres Straits region and was probably the land barrier across the Straits during the last glacial period.

TABLE 29: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO ROBUSTA*

Dorsal rays	16	16	16	17	17	17	17	18	18
Anal rays	17	18	19	16	17	18	19	17	18
Western Australia	1	–	–	3	140	18	–	5	8
Northern Territory	–	–	–	1	8	1	–	–	–
Queensland	–	–	–	–	2	15	1	–	1
New South Wales	–	–	1	–	–	18	2	–	1

TABLE 30: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO ROBUSTA*

Lateral line scales	63	64	65	66	67	68	69	70
Western Australia	–	–	7	27	19	14	10	5
Northern Territory	–	–	–	2	3	–	1	–
Queensland	3	4	2	3	1	–	–	–
New South Wales	1	1	5	8	4	3	–	–

TABLE 31: VERTEBRAE OF *SILLAGO ROBUSTA*

Abdominal	13	13	13	13	13	13	13	13	13
Modified	5	6	7	8	9	10	11	12	12
Caudal	15	14	13	12	11	10	9	8	7
Western Australia	–	–	–	–	12	36	33	8	1
Northern Territory	–	–	–	–	1	1	–	–	–
Queensland	1	1	2	8	2	–	–	–	–
New South Wales	–	–	–	11	10	–	1	–	–

Sillago (? Parasillago) boutani Pellegrin

Boutan's Whiting

Sillago boutani Pellegrin, 1905, p. 86 (Baie de Hatan, Along, North Vietnam). Fowler, 1933, pp. 421–422.

MATERIAL EXAMINED

TYPE: *Sillago boutani* Pellegrin. A radiograph of the holotype, registered 05–218 in the Museum National D'Histoire Naturelle, Paris, was kindly forwarded by Dr M. Blanc. The vertebrae number 13–4–21, a total of 38; dorsal fins XI, 1, 21; anal fin II, 22.

OTHER MATERIAL: BMNH no No., China; BMNH 55-12-27-109, China.

DIAGNOSIS

A valid species with 38 vertebrae, 13–14 + 3–4 + 21; dorsal fins XI, I, 21; anal fin II, 21–22.

DESCRIPTION

(Based on 2 specimens from China. SL 113 and 71mm).

Dorsal fins XI, 1, 21; anal fin II, 21–22. Lateral line scales 76, 5 scales above and 12–13 below. Cheek scales in 2–3 rows, the first row largest and cycloid, the lower rows have many ctenoid scales.

Proportional dimensions as percent of SL: Greatest depth of body 14.9 and 15.6; head length 27.4, 28.2; snout tip to ventral fin origin 31.0, 29.6; snout tip to spinous dorsal fin origin 34.5, 34.5; snout tip to second dorsal fin origin 55.0, 53.5; snout tip to anal fin origin 54.0, 53.5; least depth of caudal peduncle 6.6, 7.4.

Proportional dimensions as percent of head: Length of snout 38.7, 40.0; horizontal diameter of eye 19.4, 22.5; least width of interorbital 19.4, 20.0.

VERTEBRAE: 13–14 + 3–4 + 21, 13–14 abdominal, 24–25 caudal, total 38.

SWIMBLADDER: Present but not examined.

COLOUR IN ALCOHOL: After Pellegrin; Body olive-yellow dorsally, paler on the sides and abdomen; cheeks and part of operculum orange-yellow; one or two lines of orange-yellow run along the sides of the body; fine uniformly greyish with some indication of dots on the rays of the second dorsal.

DISTRIBUTION

Gulf of Tongking, and China.

REMARKS

This species is rare in collections, and may be misidentified as *Sillago sihama* as were the two specimens received on loan from the British Museum (N.H.). *Sillago boutani* may be recognised by the lateral line count of 74–76, and in having 38 vertebrae. Fowler (1933, p. 422) mentions that *Sillago bostockii* Castelnau is close to *S. boutani* in fin rays counts and number of lateral line scales. *Sillago bostockii* is a synonym of *Sillago schomburgkii*, and although the vertebrae total 37, the abdominal vertebrae in the latter species number 16 instead of the 13–14 found in *Sillago boutani*.

Sillago (Parasillago) schomburgkii Peters

Yellow Fin Whiting

(Figs. 4D, 11C, 13W, 14O, 18)

Sillago schomburgkii Peters, 1865, p. 319 (Adelaide, South Australia). Scott, 1962, pp. 187–8, fig. . Whitley, 1964, p. 43. Lenanton, 1969a, pp. 4–11; 1969b, p. 5.

Sillago bostockii Castelnau, 1873, p. 133 (Swan River and at sea, Western Australia). McCulloch, 1911, pp. 60, 63; 1912, pp. 87–8. Whitley, 1948, p. 19; 1951, p. 65.

Sillago bassensis: Waite, 1902, pp. 190–1; 1921, p. 101; 1923, pp. 123–4; 1928, p. 7 (non *Sillago bassensis* Cuvier).

Sillago frazeri Whitley, 1944, p. 270 (Leschenault Inlet, Bunbury, Western Australia); 1948, p. 19; 1951, p. 65. Roughley, 1951, p. 49.

MATERIAL EXAMINED

TYPES: *Sillago schomburgkii* Peters. Not examined. Location of holotype not known.

Sillago bostockii Castelnau. Not examined. Location of holotype not known.

Sillago frazeri Whitley. Holotype WAM P2698 in Western Australian Museum. SL 93mm; vertebrae 16–10–11, total 37. Paratype WAM P2698, SL 68mm. Whitley (1951, p. 65) placed *S. frazeri* into the synonymy of *S. bassensis*, but an examination of the holotype and a radiograph of the axial skeleton shows this species to be a junior synonym of *S. schomburgkii*. Whitley describes the juvenile colouration of this species.

OTHER MATERIAL: Western Australia: WAM PO 3 Mandurah; WAM PO 5 Mandurah; WAM PO 8–18 Shark Bay; WAM PO 21–26 Shark Bay; WAM PO185–189 Dirk Hartog Island, Shark Bay; WAM PO 303 Mandurah; WAM P7605 Carnarvon; WAM P7676–79 Denham, Shark Bay; WAM P12691–93 Murchison River; WAM P12694–97 Shark Bay; WAM P12764–72 Bush Bay, Shark Bay; WAM P12816–21 Bush Bay, Shark Bay; WAM P13186–88 Newbeach, Shark Bay; WAM P13193–202 Newbeach, Shark Bay; WAM P14707–17 Denham, Shark Bay; WAM P14743–44 Denham, Shark Bay; WAM P14752 Shark Bay; WAM P15031–46 Denham, Shark Bay; WAM P15194–221, Bibbadjiddy, Shark Bay; WAM P15212–221, Monkey Mia, Shark Bay; WAM P15558 Geraldton; CSIRO C2303 Exmouth Gulf. South Australia: WAM P15265–77 Point Prime; WAM P15293–322, WAM P15323–44 Point Clinton; WAM P15505–519 Port Augusta; SAM F829, SAM F1238–9, SAM F1242, St. Vincent Gulf.

DIAGNOSIS

Dorsal fins X–XII, 1, 19–22; anal fin II, 17–20; lateral line scales 66–76. Vertebrae total 37. Swimbladder without a median anterior extension.

DESCRIPTION

Dorsal fins X, XI, XII, 1, 20–22; anal fin II, 17–20 (Table 32). Lateral line scales 67–76 (Table 33); TR. 6–7 above, 8–10 below, 5–6 (usually 5) scales between L. lat. and spinous dorsal fin origin. Cheek scales in 4–5 rows, all ctenoid.

Proportional dimensions as percent of SL (modal frequency within parentheses): Greatest depth of body 19–22 (20); head length 24–27 (26); snout tip to ventral fin origin 26–30 (28–29); snout tip to spinous dorsal fin origin 30–33 (32); snout tip to second dorsal fin origin 51–56 (53); snout tip to anal fin origin 57–61 (58); least depth of caudal peduncle 9–10 (9).

Proportional dimensions as percent of head: Length of snout 39–44 (42); horizontal diameter of eye 17–20 (18); least width of interorbital 16–19 (17).

VERTEBRAE: 16–17 + 8–11 + 10–13, 16–17 abdominal, 20–21 caudal, total 37 (Table 34).

COLOUR IN ALCOHOL: Body sand-brown to pale silvery-grey, slightly darker above; a narrow pale silvery mid-lateral band, with a brownish band above, both bands may be indistinct; dorsal fins with rows of small brownish spots; anal fin pale yellowish to yellow with a white or cream margin; pectoral fin hyaline with some dusting of very fine spots, no dark mark or blotch at the base; caudal greyish. Juveniles have a series of dark blotches along the back and a row of 8–10 dark brown to black blotches along the sides from behind the pectoral fin to the caudal fin base.

SWIMBLADDER: The anterior margin is incised and without a median extension or anterolateral tubular projections; the posterior extension is single and narrows rapidly to a slender tube; a duct-like process is present on the ventral surface (Fig. 11C).

GEOGRAPHIC VARIATION

No geographic variation was found between Western Australia and South Australian samples.

DISTRIBUTION

Western Australia from Shark Bay southwards along the southern coast of Australia to eastern South Australia. One unconfirmed report of this species from Exmouth Gulf, W.A.

BIOLOGY

Sillago schomburgkii frequents inshore sand banks, bars and spits, and congregates in sandy hollows. At high tide this species moves in schools across the sand flats and retreats to the slopes of the banks when the tide falls. The Western Sand Whiting enters sandy estuaries in large schools, and may penetrate to the limit of the brackish water. At Mandurah and Leschenault Inlet, W.A.; large schools appear during the summer months. The Swan River once supported a large population of this species, but in recent years, apart from a few large catches during September, 1967, *S. schomburgkii* rarely enters this estuary, as the substrate has become more muddy due to reduced freshwater discharge following the construction of reservoirs.

Mr H. Nicholls (pers. comm.) informed me that schools of this species were netted in sandy areas to the north of Exmouth Gulf, and can be taken at Maud Landing, W.A.

The spawning season commences in September and is completed by January in Shark Bay (Lenanton 1969a). The juveniles frequent the shallows of protected bays and inlets and move into deeper water at maturity. The species attains a length of at least 36 cm.

TABLE 32: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO SCHOMBURGKII*

Dorsal rays	19	19	20	20	20	21	21	21	22	22	22
Anal rays	17	18	17	18	19	17	18	19	18	19	20
Western Australia	–	2	10	13	–	27	52	2	1	–	–
South Australia	1	–	2	5	1	5	42	7	15	7	1

TABLE 33: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO SCHOMBURGKII*

Lateral line scales	66	67	68	69	70	71	72	73	74	75	76
Western Australia	5	11	15	13	18	6	5	2	–	–	–
South Australia	–	1	6	7	10	9	10	8	4	3	1

TABLE 34: VERTEBRAE OF *SILLAGO SCHOMBURGKII*

Abdominal	16	16	16	16	17	17
Modified	8	9	10	11	9	10
Caudal	13	12	11	10	11	10
Western Australia	1	31	19	1	1	1
South Australia	–	14	6	–	–	–

Sillago (Parasillago) attenuata new species

Slender Whiting
(Figs. 12A, 13C, 16)

MATERIAL EXAMINED

TYPES: Holotype: SL 111 mm collected by Mr Erdman, April–June, 1948 at Tarut Bay, Ras Tanura upper bay Zaal Island, Persian Gulf. Registered USNM 147959 in the United States National Museum.

PARATYPES. USNM 207449 (3) SL 110–189 mm, data as above, collected with holotype, USNM 147959 (2 exchange specimens now WAM PO 491). USNM 147835 (13), SL 41.0–56.5 mm, 8 miles south of Al Khobar, Persian Gulf. USNM 147598, SL 65 mm, Chaschuse Island, near Damman, Persian Gulf.

DIAGNOSIS

Dorsal fins XII–XIII, 1, 19–21; anal fin II, 18–20; lateral line scales 73–77. Vertebrae total 37–39.

DESCRIPTION

(Based on the holotype and 18 paratypes; 4 paratypes SL 106–189 mm, 14 juveniles SL 41–66 mm. Characters for holotype given in parentheses).

Dorsal fins XII–XIII, 1, 19–21 (XII, 1, 21); anal II, 18–20 (II, 20). Lateral line scales 73–77 (76).

TR 6–7 above, 8–10 below (6/8), 5 scales between L. lat. and spinous dorsal origin. Cheek scales in 2 rows, cycloid above, cycloid or ctenoid below.

Proportional dimensions as percent of SL: Greatest depth of body 15–17 (15); head length 26–28 (27), juveniles 27–29; snout tip to ventral fin origin 29–30 (31), juveniles 28–31; snout tip to spinous dorsal fin origin 31–33 (31), juveniles 32–36; snout tip to second dorsal fin origin 54–56 (55), juveniles 54–57; snout tip to anal fin origin 56–59 (58), juveniles 55–60; least depth of caudal peduncle 6–8 (6), juveniles 6–7.

Proportional dimensions as percent of head: Length of snout 38–41 (37), juveniles 34–39; horizontal diameter of eye 21–24 (23), juveniles 25–29; least width of interorbital 15–17 (15), juveniles 15–18.

VERTEBRAE: (Dissected) 15–2–20 (1), 15 abdominal, 22 caudal, total 37. (Radiographs) total vertebrae 37 (1), 38 (9), 39 (1).

COLOUR IN ALCOHOL: (holotype). Body with faint blotches in two series laterally, the upper row of about 8–9 spots, the lower mid-lateral row with 10 spots; a row of indistinct spots or blotches along the base of the spinous dorsal fin; dorsal fin with the anterior most interspinous membranes dusted with black spots; membrane of the second dorsal fin sparsely dotted black; tips of the caudal fin dusted black, other fins hyaline. Juveniles with a well defined mid-lateral horizontal row of 9 elongate spots on body just below lateral line; between the lateral line and the base of the dorsal fins is a horizontal row of about 12 small spots ending before the last ray of the dorsal fin; a longitudinal row of very small spots along centre of back, 2 spots predorsally, 4 spots below spinous dorsal fin, 8–9 spots below second dorsal fin and on caudal peduncle. (A darker spot is occasionally present on upper part of the opercle in some paratypes).

SWIMBLADDER: Almost transparent and a much more delicate structure than other *Sillago* species. The one specimen examined has an elongate oval-shaped bladder without anterior extensions and possibly without a posterior extension; the most posterior part of the swimbladder was damaged, but two rudimentary posterior extensions may be present as there were two round holes in this region. A delicate duct-like process was present on the posterior ventral surface (Fig. 12A).

DISTRIBUTION

Persian Gulf.

REMARKS

Little is known of this species and further material should be studied to elucidate the structure of the swimbladder and the osteology. Two species are known from the Persian Gulf, the other species is represented by USNM 147959 (D. XI, 1, 20–21, A. II, 22; L. lat. 68–69, vertebrae 14–7–13 and is probably related to *S. sihama*; the swimbladder was not studied.

DERIVATION

From the latin 'attenuatus' meaning attenuated.

Sillago (Parasillago) asiatica McKay

Asian Whiting
(Fig. 10E, 17)

Sillago asiatica McKay, 1983, pp. 613–4.

MATERIAL EXAMINED

TYPES: Holotype: SL 131 mm, forwarded by Mr T. Wongratana from Chantaburi, Gulf of Thailand, May,

1975. Registered QM I13263 in the Queensland Museum.

PARATYPES: QM I12913 (15), QM I13264 (4) Chantaburi, Thailand. QM I13262 (THUP 00344) Taipei Markets, Taiwan.

DIAGNOSIS

Swimbladder with three anterior extensions, the middle one projecting forwards and the anterolateral ones recurved backwards along the swimbladder; a single posterior extension. Vertebrae total 34.

DESCRIPTION

(Based on the holotype).

Dorsal fins XI, 1, 21 (XI, 1, 20–22); anal fin II, 22 (II, 21–23) (Table 35). Lateral line scales 70 (67–70) (Table 36). TR. 4–5 above 8–9 below, 4 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2 rows, all cycloid.

Proportional dimensions as percent of SL (range of paratypes within parentheses): Greatest depth of body 17 (16–18); head length 27 (27–29); snout tip to ventral fin origin 28 (28–30); snout tip to spinous dorsal fin origin 34 (33–35); snout tip to second dorsal fin origin 57 (55–58); snout tip to anal fin origin 56 (55–57); least depth of caudal peduncle 8 (7–8).

Proportional dimensions as percent of head: Length of snout 36 (36–42); horizontal diameter of eye 22 (19–23); least width of interorbital 19 (18–21).

VERTEBRAE: 13-14 + 5-7 + 13-16, 13-14 abdominal, 20–21 caudal, total 34 (Table 37).

COLOUR IN ALCOHOL: Head and body pale sandy brown to light fawn, an indistinct pale mid-lateral band is present on some specimens but absent on others; belly paler, almost white; opercle and preopercle transparent with a crescentic patch of fine black-brown spots in a pigmented area the shape of the gill arches on the inside of the gill cover, showing through. Fins hyaline, the margins of the unpaired fins finely spotted with brown; the upper and lower margins of the caudal fin dark brown to almost black.

SWIMBLADDER: An anterior median extension of the swimbladder projects forward to reach the basioccipital; at each side of the base of the median extension is a simple tubular extension that is sharply recurved to extend along the swimbladder posteriorly for a distance of a tenth up to almost half its total length; a single tapering posterior extension projects into the caudal region; a duct-like process is present from the ventral surface of the swimbladder to the urogenital opening.

GEOGRAPHIC VARIATION

This new species is known from two localities only.

DISTRIBUTION

Gulf of Thailand and Taiwan. This species is possibly widespread.

REMARKS

This species was originally discovered in a small sample of *Sillago* from Taiwan, and at that time was considered to be a subspecies of *Sillago japonica*. Further material from Taiwan contained a specimen of *Sillago japonica* with a typical swimbladder and vertebrae count. Mr T. Wongratana of the Marine Fisheries Laboratory, Bangkok forwarded a number of Thai sillaginids for identification and this collection provided sufficient material of *Sillago asiatica* to be confident that the swimbladder shape and vertebrae counts were beyond the variation encountered in *Sillago japonica*. The arches on the frontal bones are wider than those of *S. japonica*, and the suborbital shelf is of different shape.

Sillago soringa Dutt and Sujatha is almost certainly a senior synonym of *S. asiatica* but is reported to differ in having the swimbladder with shorter recurved extensions and the postcoelomic part of the swimbladder relatively shorter.

DERIVATION

From the latin 'Asiaticus' meaning Asiatic.

TABLE 35: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO ASIATICA*

Dorsal rays	20	20	21	21	21	22	22
Anal rays	21	22	21	22	23	22	23
Taiwan	–	1	–	–	–	–	–
Thailand	1	2	2	13	1	2	2

TABLE 36: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO ASIATICA*

Lateral line scales	67	68	69	70
Taiwan	–	–	1	–
Thailand	1	5	6	5

TABLE 37: VERTEBRAE OF *SILLAGO ASIATICA*

Abdominal	13	14	14	14
Modified	5	5	6	7
Caudal	16	15	14	13
Taiwan	–	–	1	–
Thailand	1	3	8	2

Sillago (Parasillago) soringa Dutt and Sujatha
Soringa

Sillago soringa Dutt and Sujatha, 1983, pp. 611-614, Fig. 1.

MATERIAL EXAMINED

None. Holotype (F7734/2) and four paratypes (F7735/2) in the Zoological Survey of India, Calcutta.

DIAGNOSIS

Swimbladder with three anterior extensions, the middle one projecting forwards and the anterolateral ones recurved backwards for a short distance along the sides; a single short posterior extension. Vertebrae total 34.

DESCRIPTION

(Based on Dutt and Sujatha).

Dorsal fins XI, 1, 21; anal fin II, 22. Lateral line scales 64–68. TR, 3–4 above 9–10 below. Cheek scales in 2 rows, upper row cycloid, lower row ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 17–19; head length 28–29; snout tip to ventral fin origin 30–31; snout tip to spinous dorsal fin origin 34–35; snout tip to second dorsal fin origin 56–58; snout tip to anal fin origin 54–56; Proportional dimensions as percent of head: Length of snout 38–40; horizontal diameter of eye 24–29; least width of interorbital 19–21.

VERTEBRAE, 34; 5–7 modified.

COLOUR IN ALCOHOL: Dorsal side and upper flanks grey brown, becoming paler laterally; lower flanks and ventral side milky white. Spinous dorsal with minute discrete black dots on membrane; they are more numberous towards the distal half especially in the anterior half of the fin. In the soft dorsal, running parallel to and close to the anterior edge of each ray, is a more or less continuous grey band. The membrane of anal fin is also provided with minute black dots, but to a lesser extent than the spinous dorsal. Pectorals and ventrals hyaline with golden tinge. Caudal hyaline, with fine black dots.

SWIMBLADDER: Lanceolate, with a median finger-like extension and a pair of recurved extensions at anterior end; the swimbladder bears a single tapering postcoelomic extension and a blind tubular duct which arises from the middle of its ventral side, about 4/5 the distance from its anterior end, to terminate blindly near the vent.

REMARKS

Although Dutt and Sujatha (1983) regard their *S. soringa* as a distinct species, the close similarity to *S. asiatica* indicates that the latter species is a junior synonym of *S. soringa*. I retain both species pending a full study of the Indian material.

Sillago (Parasillago) indica McKay, Dutt and Sujatha new species
Indian Whiting
(Fig. 5E)

Sillago parvisquamis: Dutt and Sujatha, 1980, pp. 372–374.
(non *Sillago parvisquamis* Gill).

MATERIAL EXAMINED

HOLOTYPE: Zoological Survey of India, Calcutta, SL 127 mm, Visakhapatnam, India, collected K. Sujatha, June 8, 1979.

PARATYPES: (data as holotype) BMNH London, SL 158 mm; QM I20386, SL 140 mm; MNHN Paris, SL 122 mm.

DIAGNOSIS

Dorsal fins XI, 1, 21–22; anal fin II 22–23; lateral line scales 68–70; total vertebrae 34 of which 3 are modified; swimbladder with bifurcate anterior extension, anterolateral extensions recurved and extend to ventral duct, posterior extension single; a dark band on sides sometimes broken into blotches.

DESCRIPTION

(Based on material above and description by Dutt and Sujatha).

Dorsal fins XI, 1, 21–22; anal fin II, 22–23 (21–23). Lateral line scales 68–70 (69–76, 80 in one). TR, 6 above, 11–12 below, 5 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2–3 rows all cycloid except for occasional ctenoid scale posteriorly.

Proportional dimensions as percent of SL: Greatest depth of body 18–21; head length 28–29; snout tip to ventral fin origin 30–31; snout tip to spinous dorsal fin origin 33–34; snout tip to second dorsal fin origin 53–57; snout tip to anal fin origin 54–57; least depth of caudal peduncle 7–8.

Proportional dimensions as percent of head: Length of snout 37–40; horizontal diameter of eye 18–21; least width of interorbital 18–21.

VERTEBRAE: total 34, 3 modified.

COLOUR IN ALCOHOL: Body light tan with a dark brown to blackish band commencing behind the upper part of the opercle and curving down below the lateral line for approximately two-thirds its length and then continuing slightly below or on the lateral line as a more or less

broken band or as distinct elongate spots or blotches, to hypural flexure; head and cheeks with fine black dots; belly and lower sides may be densely dotted, almost blackish; interspinous membranes of first dorsal fin with very numerous black dots; interradial membranes of second dorsal and anal fin dusted with black dots, most concentrated immediately before each ray; caudal dusted with black, lower lobe may be blackish.

SWIMBLADDER: Posterior extension single, long and tapering to a fine point; anterior margin of swimbladder with a well developed bifurcate (rarely trifurcate) median extension that extends anteriorly to each side of the basioccipital; a very fine anterolateral tubular extension extends forward and then sends off a rather convoluted or almost straight branch that recurves around the lateral projections of the main body of the swimbladder to the ventral duct or beyond; the main body of the swimbladder has lateral horns entering the musculature anteriorly and is somewhat serrated posteriorly; the postcoelomic extension commences abruptly and continues posteriorly as a long gradually tapering fine tube; the ventral duct arises somewhat posterior to the postcoelomic extension and continues posteriorly and ventrally to behind the vent (Fig. 5E). In two of the three specimens examined the fine anterolateral tube that extends alongside the swimbladder is joined to and appears to communicate with the second lateral horn-like projection of the swimbladder.

DISTRIBUTION

East and west coasts of India.

REMARKS

Sillago indica, reported as *S. parvisquamis* by Dutt and Sujatha (1980) can be recognised by the dark lateral band, low number of vertebrae and the complex swimbladder that resembles that of *Sillago sihama* but differs in having a single postcoelomic extension. This species was also reported from Karwar by the above authors and therefore has a wide distribution in India. It was not collected by the CMFRI survey at Cochin (McKay, 1980).

As this revision was delayed by lack of publishing funds I have included *Sillago soringa* Dutt and Sujatha (1983) and have taken the opportunity of describing *Sillago indica* pending a revision of the sillaginid fishes of India by myself, Dr S. Dutt and Mrs K. Sujatha. The sillaginid fishes of Sri Lanka and Burma are little known and require detailed study.

Sillago (Parasillago) macrolepis Bleeker

Large-scale Whiting
(Fig. 4E, 13I, 18)

Sillago macrolepis Bleeker, 1859, p. 166 (Batavia; Bodeling, Bali); 1874, p. 72; 1877, pl. 389, fig. 1. Günther, 1860, p. 246. Meyer, 1885, p. 28. Evermann and Seale, 1907, p. 87. De Beaufort, 1913, p. 120. Fowler, 1928, p. 235; 1933, p. 416; 1934, p. 422. Weber and de Beaufort, 1931, p. 171. Herre, 1933, p. 4; 1934, p. 58; 1953, p. 478. Munro, 1958, p. 178; 1967, p. 346.

MATERIAL EXAMINED

TYPE: Not examined. Location of the holotype is unknown.

OTHER MATERIAL: New Britain (4); CSIRO A139, Ring Ring; CSIRO FO1464, New Britain; CSIRO FO1857 12), Talasea, Philippines (10); Mindanao; USNM 57903, Zamboanga; USNM 145117, Cotabato, Mindanao River; USNM 150642 (2), Davao, Negros; CAS-GVF 1606 (2), Dumaguete, Luzon; 2 specimens from Manilla forwarded by the National Museum, AM, I.17482-018 (9), Lavoro Creek Guadalcanal, Solomon Islands.

DIAGNOSIS

A species with 51–56 lateral line scale, 19–21 dorsal rays, 19–21 anal rays, and no haemal bridge overlying the swimbladder.

DESCRIPTION

Dorsal fins XI, 1, 19–21; anal fin II, 19–21 (Table 38). Lateral line scales 51–55 (Table 39). TR. 4 above, 6 below. Cheek scales in 2 rows, mostly cycloid.

Proportional dimensions as percent of SL: Greatest depth of body 18–20; head length 24–30; snout tip to ventral fin origin 27–30; snout tip to spinous dorsal origin 30–33; snout tip to second dorsal fin origin 52–55; snout tip to anal fin origin 53–55; least depth of caudal peduncle 7–8.

Proportional dimensions as percent of head: Length of snout 27–29; horizontal diameter of eye 25–32; least width of interorbital 17–18.

VERTEBRAE: 14 abdominal, 20 caudal, total 34.

COLOUR IN ALCOHOL: Yellowish, darker above, with a diffuse silvery longitudinal mid-lateral band; dorsals dusky with a narrow blackish margin. Juveniles with a series of small brown spots, one on each side along the back at the base of the dorsal fins; first dot at commencement of spinous dorsal, second about middle of spinous dorsal, third below fourth dorsal ray, fourth below eleventh dorsal ray, and last spot below end of rayed dorsal fin.

SWIMBLADDER: Well developed without anterior and posterior extensions in juveniles; a

duct-like process present from the ventral surface of the swimbladder to the urogenital aperture. Adult specimens not yet examined.

DISTRIBUTION

Recorded from the Indonesian Archipelago, New Britain, Solomon Islands and the Philippine Islands (see Fig. 18).

REMARKS

Evermann and Seale (1907, p. 87) recorded a lateral line count of about 60 in two specimens from Bulan, Luzon; lateral line scale counts I have made on the material listed above range from 51–55. Dutt and Sujatha (1980, pp. 372–74) record *S. macrolepis* from Visakhapatnam, India. Their material, with a lateral line scale range of 60 to 67 and with 3 modified haemal vertebrae, belongs to *S. lutea*.

TABLE 38: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO MACROLEPIS*

Dorsal rays	19	19	19	20	20
Anal rays	19	20	21	20	21
New Britain	–	3	1	–	
Solomon Islands	2	7	–	–	–
Philippines	1	4	1	1	1

TABLE 39: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO MACROLEPIS*

Lateral line scales	51	52	53	54	55
New Britain	–	–	1	1	–
Solomon Islands	–	–	6	1	1
Philippines	1	1	4	1	–

Sillago (Parasillago) argentifasciata Martin and Montalban

Silver-Banded Whiting
(Fig. 5A)

Sillago argentifasciata Martin and Montalban, 1935, pp. 226–7, pl. 1, fig. 3 (Lumbucan Island, Palawan, Philippines). Herre, 1953, p. 478, No. 1175).

MATERIAL EXAMINED

TYPES: The holotype and two paratypes were deposited in the collection of the Fish and Game Administration. Dr Ocampo, National Museum, Manila informed me (*pers. comm.* September 27, 1966) that the type specimens were destroyed during World War II.

DIAGNOSIS

Dorsal fins XI, 1, 17–18; anal fin II, 17; lateral line scales 66. No irregular dark blotches on sides; a wide, brilliant, silvery, longitudinal band on each side of the body. Cheek with three rows of scales, those on the upper row cycloid, and on the lower two rows ctenoid.

DESCRIPTION

(Based on Martin and Montalban 1935).

Dorsal fins XI, 1, 17–18; anal fin II, 17; lateral line scales 66. TR. 5 above, 9 below. Cheek scales in three rows, the upper row cycloid, the lower two rows ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 19–20; head length 29–30; least depth of caudal peduncle 8.

Proportional dimensions as percent of head: Length of snout 38–42; horizontal diameter of eye 28–29; least width of interorbital 18.

COLOUR IN ALCOHOL: Dull silvery white; a well-pronounced, brilliant, silvery, longitudinal band, widest between the anterior portions of anal and second dorsal, runs on side from above base of pectoral to base of caudal; anteriorly this band is below the lateral line and posteriorly its upper edge touches it; breast and opercle brilliant silvery; upper portion of each dorsal spine and ray sparsely dotted with blackish; all other fins hyaline.

DISTRIBUTION

Lumbucan Island, Philippines

REMARKS

Sillago argentifasciata was not included in the large amount of material examined from the Philippines. Further collecting at the type locality and the designation of a neotype is necessary to resolve the identity of this species. This species is similar to *Sillago ingenuua* any may prove to be a senior synonym; see also remarks under *Sillago ingenuua*.

Sillago (Parasillago) lutea, new species

Mud Whiting
(Figs. 10D, 13H–I, 18)

Sillago macrolepis: Dutt and Sujatha, 1980, pp. 372–74 (non *Sillago macrolepis* Bleeker).

MATERIAL EXAMINED

TYPES: Holotype: SL 130 mm, collected by trawl net in Exmouth Gulf, Western Australia, February, 1968, R.J. McKay. Registered WAM P15928 in the Western Australian Museum.

PARATYPES (377): WAM PO 605–17, PO 752–3, PO 822–64, Admiralty Gulf, WAM PO 676–82, Borda Island; CSIRO C2361, Dampier Archipelago; WAM P15878–910, PO 335–59, PO 361–5, PO 386–442, PO

492–583, PO 601–4, PO 683–735, CSIRO C2553, Exmouth Gulf; WAM PO 762, King Bay; WAM PO 787–92, PO 960–9, Mitchell River area; WAM PO 465, PO 470–71, Nichol Bay; WAM PO 469, West Moore Island; Western Australia. WAM P14261, P14398, P14480–3, P15093–106, Darwin, Northern Territory. WAM P13223, AM IB5890, QM 111101 (4), Gulf of Carpentaria, Queensland.

OTHER MATERIAL: (4) Visakhapatnam, India, August 4, 1981, K. Sujatha, S.L. 108–120 mm.

DIAGNOSIS

Dorsal fins XI, 1, 20–22; anal fin II, 21–23; lateral line scales 67–72. Normally 13 abdominal vertebrae. Swimbladder with a median anterior extension and with or without rudimentary anteriorly directed anterolateral projections; posterior extension single. A small species taken by trawl net.

DESCRIPTION

(Based on the holotype and 33 paratypes from Exmouth Gulf, Western Australia. SL 120–141 mm. Characters for the holotype given in parentheses).

Dorsal fins XI, 1, 20–22 (XI, 1, 22); anal II, 21–23 (II, 22) (Table 40). Lateral line scales 67–72 (69) (Table 41). TR. 6–7 above, 9–11 below (7/10), 5 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2 rows, mostly cycloid, occasional specimens with a few ctenoid scales posteriorly.

Proportional dimensions as percent of SL: Greatest depth of body 16–20 (17.3); head length 27–29 (28.8); snout tip to ventral fin origin 28–32 (29.2); snout tip to spinous dorsal fin origin 32–35 (34.6); snout tip to second dorsal fin origin 55–58 (55.4); snout tip to anal fin origin 52–56 (55.4); least depth of caudal peduncle 7–8 (7.9).

Proportional dimensions as percent of head: Length of snout 37–43 (40.6); horizontal diameter of eye 20–24 (19.8); least width of interorbital 18–21 (19.3).

VERTEBRAE: 13–14 + 4–11 + 10–17, 13–14 abdominal, 20–22 caudal, total 33–35 (Table 42).

COLOUR IN ALCOHOL: Body light sandy-brown above, pale brown to whitish below, with an ill defined silvery mid-lateral band; margins of scales may be slightly darker giving a vague meshwork pattern to the body above the lateral line; fins hyaline, the spinous dorsal fine membrane tipped with a fine dusting of black; no dark spot at the base of the pectoral fin.

SWIMBLADDER: A short median anterior extension and with the anteriorly directed anterolateral projections rudimentary or well developed; posterior extension single; a duct-like process on the ventral surface present. The swimbladder is similar to that of *Sillago japonica*.

GEOGRAPHIC VARIATION

Samples from Napier Broome Bay, and Mitchell River at Admiralty Gulf had fewer modified vertebrae (4–7) instead of the normal (7–10) of the other samples from Admiralty Gulf and elsewhere. Larger samples from Admiralty Gulf should be counted for verification.

DISTRIBUTION

Exmouth Gulf, W.A., northwards and eastwards to Gulf of Carpentaria. India and Sri Lanka.

BIOLOGY

This species is commonly associated with the Banana Prawn *Penaeus merguiensis* de Man in northern Australia, and occurs most abundantly on muddy or very silty substrates. Large catches are taken by prawn trawlers but as the species attains sexual maturity at SL 100 mm (ripe females 104–120 mm) and grows to only 16 cm, the catch is of no commercial importance at present.

REMARKS

Sillago lutea may be confused with *Sillago sihama* and *Sillago japonica*. The swimbladder and cranial osteology is very similar to that of *Sillago japonica*, and occasional specimens have the same vertebrae count. *Sillago lutea* was originally considered to be a subspecies of *Sillago japonica* but as the majority of specimens have 13 abdominal vertebrae and a total of 33 rather than 14 abdominal vertebrae and a total of 34, and attain sexual maturity at a smaller size, the two species are believed to be valid ones despite an obvious relationship. The scales between the spinous dorsal origin and the lateral line afford reliable external determination of the two species as *S. lutea* has 5 scales and *S. japonica* 3.

This species may be widespread throughout the Indian Ocean as a small sample from the southern and middle part of the Pearl Banks, Gulf of Mannar, Sri Lanka, appeared to be *S. lutea* with a vertebrae count of 13-9-10, but with a slightly more expanded tip to the subocular shelf. Specimens from India agree well with Australian material.

DERIVATION

From the latin 'luteus' meaning belonging to mud.

TABLE 40: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO LUTEA*

Dorsal rays	20	20	20	21	21	21	22	22	22
Anal rays	21	22	23	21	22	23	21	22	23
Western Australia	6	5	–	1	45	16	2	5	4
Northern Territory	–	3	–	1	11	3	–	1	–
Queensland	–	1	1	–	3	–	–	–	–

TABLE 41: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO LUTEA*

Lateral line scales	67	68	69	70	71	72
Western Australia	1	14	21	24	6	1
Northern Territory	3	5	2	1	1	–
Queensland	–	–	4	–	–	–

TABLE 42: VERTEBRAE OF *SILLAGO LUTEA*

Abdominal	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	14	14	14	14
Modified	4	5	5	6	7	8	8	8	9	9	9	10	10	10	11	8	9	9	10
Caudal	17	15	16	15	14	12	13	14	11	12	13	10	11	12	10	12	11	12	10
Western Australia	1	1	2	9	7	2	48	1	–	172	9	–	59	3	1	–	1	3	1
Northern Territory	–	–	–	–	1	–	1	–	2	2	–	3	1	–	–	1	–	–	–
Queensland	–	–	–	–	–	–	1	–	–	2	–	–	3	–	–	–	–	–	–

Sillago (Parasillago) japonica Temminck and Schlegel

Shiro-gisu or Japanese Whiting
(Figs. 5B, 11A–B, 14Q, 16)

Sillago japonica Temminck and Schlegel, 1843, pp. 23, 24, pl. 10, fig. 1 (Japan). Richardson, 1846, p. 223. Bleeker, 1853, p. 28; 1858, p. 11; 1859, p. 163, 1875, pp. 69–71; 1877, pl. 389, fig. 6; 1879, p. 9. Günther, 1860, pp. 244–5; 1880, p. 66. Gill, 1861, pp. 503–4. Steindachner and Doderlein, 1885, p. 192. Jordan and Snyder, 1901, p. 109; 1902, p. 487. Smith and Pope, 1906, p. 478. Jordan, Tanaka and Snyder, 1913, p. 187. Fowler and Bean, 1922, p. 69. Jordan and Hubbs, 1925, p. 248. Reeves, 1927, p. 10. Mori, 1928, p. 6. Fowler, 1930, p. 654; 1931, p. 302; 1949, p. 51. Weber and de Beaufort, 1931, pp. 170, 173–4. Herre, 1945, p. 118; 1953, p. 478. Boeseman, 1947, p. 38. Tomiyama and Abe, 1958, pp. 1171–6. Munro, 1958, p. 178; 1967, p. 347. Hotta, 1961, p. 62. Whitehead and Joysey, 1967, p. 139.

Sillago sihama: Steindachner and Doderlein, 1885, p. 192. Nogusa, 1951, pp. 153–5; 1960, p. 26. Ueno and Fujita, 1954, pp. 118–20, fig. 1. Okada, 1955, p. 256. Hotta, 1961, p. 62, pl. 33, fig. 99. Takahashi, 1962, p. 24, pl. 57. Kawanabe, Saito, Sunaga, Maki and Azuma, 1968, p. 54. (non *Sillago sihama* Forskal).

MATERIAL EXAMINED

TYPE: *Sillago japonica* Temminck and Schlegel. A radiograph of the lectotype selected by Boeseman (1947, p. 38), registered No. 367 in the Rijksmuseum van Natuurlijke Histoire, Leiden, was kindly forwarded by Dr M. Boeseman, the vertebrae count of 14–8–13 agrees well with material collected from Japan.

OTHER MATERIAL: Japan (92); WAM 15523–6, Tsuyazaki, Fukoka Prefecture, Kyushu; Dr Y. Okada 56–136, 56–138, Aiura Coast, Seseho City, Kyushu; Dr Y. Okada 56–177–8, Kyushu, trawled; WAM PO 67–70 Tokyo; USNM 44876, USNM 26241, USNM 92787, USNM 75968, USNM 57528, USNM 59670, USNM 57591, AMNH 17126, Japan, no location; USNM 38795, USNM 49085, USNM 49804, USNM 71349, Tokyo, AMNH 13165, Miyadsu, Kyoto; AMNH 888, QM 112698–9, QM 113261 (2), Sagami Bay; AMNH 3709, AMNH 3699, Shimnosaki market; AMNH 13162, Toba, Honsu Island; USNM 151662, Mikawa Bay; USNM 22593, Awa; USNM 71343, Tsurunga; USNM 71291, Shimizu; USNM 71348, Kagoshima; USNM 59669, Yamagawa; USNM 151811, Toba market; USNM 152510, Nagano Prefecture.

Korea, (2); USNM 143407, Fusan. Taiwan (8); WAM PO 475, THUP 02372, QM 113276, Taipei; USNM 76635, USNM 76636, Takao. China (5); USNM 87031, Foochow; USNM 130530, Ningpo, Chekiang; USNM 130476, Tsingtao, Shantung; USNM 86101, Wen-chou. East Asia. USNM 37984, no locality.

DIAGNOSIS

Dorsal fins XI, 1, 21–23; anal fin II, 22–24; total vertebrae 35 (8–9 modified vertebrae overlapping posterior extension of swimbladder). Swimbladder with anterior projecting extensions and a single posterior extension.

DESCRIPTION

(Based on 24 examples from Japan. SL 103–208 mm).

Dorsal fins XI, 1, 21–23; anal fin II, 22–24 (Table 43). Lateral line scales 70–73 (Table 44). TR. 5–6 above, 8–10 below, 3 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2 rows, upper row usually cycloid. Lower row with cycloid and ctenoid scales.

Proportional dimensions as percent of SL (modal frequency within parentheses): Greatest depth of body 15–19 (17–18); head length 26–29 (27); snout tip to ventral fin origin 28–32 (29); snout tip to spinous dorsal fin origin 31–36 (33); snout tip to second dorsal fin origin 53–58 (56); snout tip to anal fin origin 53–57 (56); least depth of caudal peduncle 6–8 (7).

Proportional dimensions as percent of head: Length of snout 34–42 (37); horizontal diameter of eye 19–25 (20); least width of interorbital 18–22 (22).

VERTEBRAE: 14+8–9+12–13, 14 abdominal, 21 caudal, total 35 (Table 45).

COLOUR IN ALCOHOL: (from Tomiyama and Abe). Body greenish-grey above, the dorsal part of the head being the darker, and whitish below; anterior and posterior dorsal fins mostly hyaline, the membrane between the first and second and the second and third dorsal spines having minute dark brown dots; margins of dorsal fins with a few dark brown spots; anal and ventral fins hyaline; pectoral fins hyaline with the upper margin and base dark greenish; caudal whitish with dark margins.

SWIMBLADDER: Posterior extension single, long and tapering to a slender point; anterior margin of swimbladder with a long median extension reaching to, or almost to, the basioccipital, and on each side at the anterolateral surface, is a long slender anteriorly directed blind tubular extension almost as long as the median one (Fig. 11A–B). All specimens examined from Taiwan and Japan (9) were as above, the specimens from Korea and China were not examined, identification in the latter examples was from vertebrae counts and external characters.

GEOGRAPHIC VARIATION

No geographic variation was observed.

DISTRIBUTION

Japan, Korea, China and Taiwan.

BIOLOGY

Nogusa (1951, 1960) has described the chromosomes and Ueno and Fujita (1954) the development of the egg; both authors referring the species to *Sillago sihama*.

Sillago japonica is the common whiting of Japan, occurring in bays on shallow sandy flats. It attains at least 22 cm in length.

REMARKS

Sillago japonica is externally very similar to *Sillago sihama* and has been frequently confused with the latter species. Positive identification is afforded by the shape of the swimbladder and the vertebrae count. Cranial osteology, otoliths and hypural plate morphology also permits the identification of *S. japonica*. I have examined only two species from Japanese waters, *S. parvisquamis* and *S. japonica*. I suspect that a third species may be discovered by trawling vessels.

Sillago asiatica sp. nov. has been confused with *Sillago japonica*; the two species are sympatric in Taiwan. The swimbladder morphology and vertebrae counts allows the two species to be readily identified.

TABLE 43: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO JAPONICA*

Dorsal rays	21	21	21	22	22	22	23	23
Anal rays	22	23	24	22	23	24	23	24
Japan	5	12	1	7	50	10	1	1
Korea	–	–	–	–	2	–	–	–
China	–		–	–	3	–	1	–
Taiwan	–	1	–	2	4	–	–	–

TABLE 44: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO JAPONICA*

Lateral Line Scales	68	69	70	71	72	73	74
Japan	–	–	6	9	18	7	1
Korea	–	–	–	1	1	–	–
China	–	–	–	2	–	–	–
Taiwan	1	–	–	–	–	1	–

TABLE 45: VERTEBRAE OF *SILLAGO JAPONICA*

Abdominal	14	14
Modified	9	8
Caudal	12	13
Japan	9	4
China	1	–
Taiwan	2	–

Sillago (Parasillago) ingenuua new species

Bay Whiting
(Fig. 8C, 14P)

Sillago argentifasciata, Shao and Chang, 1978, p. 9; 1979, pp. 695–705 Dutt and Sujatha, 1980, p. 371–375 (non *Sillago argentifasciata* Martin and Montalban).

MATERIAL EXAMINED

TYPES: Holotype: SL 142 mm, collected form Chantaburi Gulf of Thailand, May 1975, explosives, forwarded by Mr T. Wongratana. Deposited in the collection of the Marine Fisheries Laboratory, Department of Fisheries, Bangkok, Thailand.

PARATYPES: QM I12916 (14) data as above. Deposited in the Queensland Museum.

OTHER MATERIAL: QM I16750–56, I16796–815, Torres Straits, 1974.

DIAGNOSIS

Dorsal fins XI, 1, 17; anal fin II, 17; lateral line scales 66–70; no black spot on pectoral base; swimbladder with a short median anterior extension and about 5 small pointed anterolateral projections (Fig. 8C); no wide distinct silvery lateral band; 13 abdominal vertebrae; cheek scales ctenoid.

DESCRIPTION

(Based on the holotype and 14 paratypes SL 105–158 mm. Characters for holotype given in parentheses).

Dorsal fins XI, I, 17 (XI, 1, 17); anal fin II, 17 (II, 17); lateral line scales 66–70 (69). TR. 3–4 above 8–9 below (4/9). Cheek scales in 2–3 rows (3) all ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 16–20 (18); head length 27–29 (27) snout tip to ventral fin origin 28–32 (29); snout tip to spinous dorsal fin origin 32–34 (33); snout tip to second dorsal fin origin 55–57 (57); snout tip to anal fin origin 54–58 (55); least depth of caudal peduncle 6–8 (7).

Proportional dimensions as percent of head: Length of snout 37–42 (37); horizontal diameter of eye 19–23 (23); least width of interorbital 19–20 (20).

VERTEBRAE: 13–9–11 (3), 13–10–10 (3), 13–11–9 (1); 13 + 9–11 + 9–11; 13 abdominal, 20 caudal; total 33.

COLOUR IN ALCOHOL: Head and body pale sandy brown to light fawn; no conspicuous mid-lateral silvery band; no dark spot at base of pectoral fin; all fins hyaline. The opercles are almost translucent and the dark brown inner surface shows through. Tip of snout dark in some paratypes.

SWIMBLADDER: A short median anterior extension is present in the 10 specimens examined, but appears to be longer in the larger individuals; five short, pointed anterolateral projections are present, the anterior two on each side projecting almost laterally, the posterior ones pointing posteriolaterally; a single tapering posterior extension; a poorly developed duct-like process is present ventrally.

DISTRIBUTION

Known from the Gulf of Thailand, Taiwan, Northern Australia and India.

REMARKS

Sillago ingenuua resembles *Sillago lutea* in appearance and like the latter species may not attain a large size. The fin ray counts and lateral line scale counts agree to some extent with those of *Sillago argentifasciata,* but the absence of a well defined silvery mid-lateral band, the ctenoid upper cheek scales, and the smaller eye of *Sillago ingenuua* suggests that both species are distinct. The swimbladder of this new species resembles that of *S. ciliata* and *S. analis,* but the lateral line scale count differs from both species and the vertebrae count if quite distinct. The frontal bone arches are considerably narrower than those of *S. ciliata* and *S. analis,* and the suborbital shelf is of very different shape.

DERIVATION

From the latin 'ingenuus' meaning free-born, in reference to Thailand.

REMARKS

The peritoneum of *S. ingenuua* is black-brown; *S. lutea* has the peritoneum pale, with scattered black dots or speckled areas.

Sillago (? Parasillago) microps new species

Small-eyed Whiting

MATERIAL EXAMINED

HOLOTYPE: SL 170 mm, collected by D.K. Lawless, Taipei Market, Taiwan, registered USNM 208326 in the United States National Museum.

PARATYPE: SL 198 mm, registered USNM 208327, data as above.

DIAGNOSIS

Dorsal fin XI, 1, 19; anal fin II, 19; a small eye (14–16% head length); vertebrae 13–5–16; cheek scales cycloid.

DESCRIPTION

(Based on the holotype and paratype. Characters of the holotype given in parentheses).

Dorsal fins (XI, 1, 19) XI, 1, 19; anal fin (II, 19) II, 19. Lateral line scales (68) 69. 5 scales between L. lat. and spinous dorsal fin origin. Cheek scales in 2 rows, all cycloid.

Proportional dimensions as percent of SL: Greatest depth of body (18.3) 16.7; head length (27.0) 27.8; snout tip to ventral fin origin (29.4) 30.8; snout tip to spinous dorsal fin origin (34.7) 35.4; snout tip to second dorsal fin origin (56.5) 58.0; snout tip to anal fin origin (56.5) 57.5; least depth of caudal peduncle (5.9) 6.6.

Proportional dimensions as percent of head: Length of snout (40.2) 43.6; horizontal diameter of eye (16.0) 14.0; least width of interorbital (15.6) 15.4.

Eye diameter as percent of snout length (37.8) 33.3.

VERTEBRAE: 13 abdominal, 5 modified, 16 caudal; 13+21; total 34.

COLOUR IN ALCOHOL: Body very pale brown, darker above, belly white; faint longitudinal pale brown lines on lower sides; a longitudinal greenish-grey mid-lateral band below lateral line; fins translucent, the spinous dorsal with a dusting of fine brown spots.

REMARKS

This new species is known only from the holotype and one paratype from Taiwan, collected with two specimens of *Sillago parvisquamis,* and one specimen of *Sillago sihama.* The cranial osteology and swimbladder structure is unknown at present.

DERIVATION

In reference to the small eye.

Sillago (Parasillago) vincenti McKay

Estuarine Whiting
(Figs. 4B, 12B, 13E, 14C)

Sillago vincenti McKay, 1980, pp. 378–381, Fig. 1A–C (Kavanad near Neendakara, Kerala State, India).

MATERIAL EXAMINED

HOLOTYPE: T116, SL 207 mm, Mandapam Camp, India.

PARATYPES: AMS I.21423-001 (1), CMFRI (4), USNM (2), WAM P26850-001 (1), Mandapam Camp (10); Kavanad, Kerala State, India. ANSP 143065 (2), BPBM 22899 (4), BM 1980.4.2.1 (1), CAS 45628 (2), CMFRI (31 defleshed), MNNH 1980–1121 (1), NSMT - P18653 (1), QM I17299 (2) IO 17778–9 (otoliths), RUSI (1), UMMZ 205336 (1), Mandapam Camp (10); Cochin, Kerala State, India.

DIAGNOSIS

Body uniformly coloured, second dorsal fin spotted; anal fin II 22–24. Swimbladder with a single posterior extension, a short bulbous projection anteriorly with one to three anterolateral lobate or recurved projections; no tubular extensions anteriorly.

DESCRIPTION

Dorsal fins XI, 1, 21–23; anal fin II, 22–24 (see Table 46). Lateral line scales 70–74 (see Table 47). TR. 5–6 above, 13–14 below. Cheek scales in 2 rows all cycloid.

Proportional dimensions as percent of SL: Greatest depth of body 16–20; head length 26–29; snout tip to ventral fin origin 26–30; snout tip to spinous dorsal fin origin 31–35; snout tip to second dorsal fin origin 52–55; snout tip to anal fin origin 54–55; least depth of caudal peduncle 6–7.

Proportional dimensions as percent of head: Length of snout 40–46; horizontal diameter of eye 17–22; least width of interorbital 16–19.

VERTEBRAE: 14 abdominal, 4–6 precaudal, 14–16 caudal; 14+20, total 34 (see Table 48).

COLOUR IN ALCOHOL: Body light olive above; belly whitish; margins of scales darker; spinous dorsal hyaline with the tip of membranes dusky or blotched; soft dorsal hyaline with 5–7 rows of blackish spots; anal fin whitish.

COLOUR IN LIFE: Body and head sandy to light olive above, scale margins darker, sides silvery with a golden tinge, belly white; head with a deeper golden tinge, the snout, preorbital and suborbital areas translucent, showing the golden surface on the lachrimal and suborbitals below; the ventral surface transparent to translucent with a pink hue. Eye with a silver iris, somewhat golden on the outer surface, snout tip dusky and the frontal bones outlined with darker pigmentation; opercle yellowish-gold. Pectoral fin base yellow to gold. Ventral fins white with yellowish tips. Spinous dorsal fin hyaline with the tip of the membranes dusky and blotched with irregular areas of very fine dust-like black spots; rayed dorsal fin hyaline to pale white 5–7 rows of blackish spots that may become somewhat confluent in large examples. Anal fin hyaline to milk-white with white or yellowish tips. Caudal fin hyaline to dusky with the lower lobe and posterior margin darker in some specimens. Sides of body without a well defined silvery lateral stripe.

SWIMBLADDER: The anterior extremity has a very short bulbous projection with one to three anterolateral lobate or recurved projections (Fig. 12B). The posterior postcoelomic extension is single and tapers to a point; a duct-like process is

present on the ventral surface and continues to the vent.

DISTRIBUTION

Estuarine areas of Kerala State, India.

BIOLOGY

McKay (1980) reported females of 250 to 277 mm running ripe in late January to early February. It occurs with *Sillago sihama* apparently in mixed schools on muddy substrates.

REMARKS

This species is very similar in external morphology to *Sillago sihama*. A dissection of the posterior part of the swimbladder is required for field identification.

TABLE 46: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGO VINCENTI*

Dorsal rays	21	21	22	22	22	23	23	23
Anal rays	22	23	22	23	24	22	23	24
Kerala State	2	1	26	31	3	1	9	1

TABLE 47: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGO VINCENTI*

Lateral Line Scales	70	71	72	73	74
Kerala State	4	31	25	11	3

TABLE 48: VERTEBRAE OF *SILLAGO VINCENTI*

Abdominal	14	14	14	14
Modified	4	5	6	4
Caudal	16	15	14	17
Kerala State	1	15	2	1

Genus **Sillaginodes** Gill, 1861.

Sillaginodes Gill, 1861, type by original designation *Sillago punctata* Cuvier, 1829.

DIAGNOSIS

Dorsal spines XII to XIII, dorsal rays 25 to 27; anal fin with II spines and 21 to 24 rays; lateral line scales 129 to 147; swimbladder with a posterior extension but no duct-like process to the urogenital aperture; vertebrae 42 to 44. One species.

Sillaginodes punctata (Cuvier)

King George or Spotted Whiting
(Fig. 5C, 12F, 13X, 14S, 16)

Sillago punctata Cuvier, *in* Cuvier and Valenciennes, 1829, p. 413 (Port King George). Quoy and Gaimard, 1834, pp. 671–2, pl. 1, fig. 1. Günther, 1860, p. 245. Schmeltz, 1869, p. 16; 1879, p. 44. Castelnau, 1872, p. 93. Klunzinger, 1879, p. 370. Macleay, 1881, p. 201. Waite, 1904, p. 31; 1921, p. 100, fig. 152. Stead, 1906, p. 574; 1908, p. 66, pl. 36. McCulloch, 1921, p. 60. Fowler, 1930, p. 654. Roughley, 1951, p. 49, pl. 17. Parrott, 1959, p. 201.

Sillaginodes punctata: Gill, 1861, p. 505.

Sillaginodes punctatus: McCulloch, 1927, p. 50, pl. 21, fig. 183a. Waite, 1928, p. 7. Fowler, 1933, pp. 431–2. Sandars, 1945, p. 107. Whitley, 1948, p. 19; 1955, p. 331; 1962, p. 105; 1964, p. 43. Scott, 1962, pp. 186–7.

Isosillago maculata Macleay, 1879, p. 34, pl. 4, fig. 3 (King George Sound).

Isosillago punctata: McCulloch, 1911, pp. 59–60.

MATERIAL EXAMINED

TYPES: *Sillago punctata* Cuvier. A radiograph of the two syntypes registered A.3148 in the Museum National d'Histoire Naturelle, Paris, forwarded by Dr M. Blanc, shows the vertebrae to number 21–6–17 and 21–7–16. The largest specimen approximately 285 mm in total length is here designated lectotype.

Isosillago maculata Macleay. The location of the type specimens are unknown, Stanbury (1969) makes no mention of the types, and they are not listed in the collection of the Australian Museum. McCulloch (1911, p. 60) made an examination of the types and states 'I find that the number of spines and rays in the dorsal and anal fins are incorrectly stated in the original description. There are thirteen spines in the first dorsal and one spine and twenty-four or five rays in the second; the anal has twenty-four spines and rays in all. In these and all other characters they agree with *Sillago punctata,* Cuv. and Val.,.....'.

OTHER MATERIAL: Western Australia (53); WAM PO 4, Mandurah; WAM P7197, Bussleton; WAM P7898, Denmark; WAM PO 71, Frenchmans Bay, Albany; WAM PO 73–91, Oyster Harbour, Albany; WAM P15030, Oyster Harbour, Albany; WAM P15684–712, Albany. South Australia (121); WAM PO 225–39, Denial Bay, Ceduna; WAM P15384–422, Baird Bay; WAM P15643–53, Port Lincoln; WAM PO 246–63, Port Lincoln; WAM P15345–51, Dutton Bay; SAM F1874–5, Cowell; SAM F1894 (2), F1899 (2), F1903 (2), F1905 (2), F1925 (3), Shallowwater Point (Shoalwater Point); WAM P15494–504, Port Augusta; SAM F1861–2 (2), F1928 (3), Wallaroo; SAM F1927 (2), near Moonta. Victoria (31); WAM PO 642–53, Port Phillip Bay; WAM PO 736–46, San Remo; WAM PO 802–9, Port Franklin.

DIAGNOSIS

A large species with 129–147 lateral line scales.

DESCRIPTION

(Based on 35 examples from Oyster Harbour, near King George Sound, Albany, Western Australia. SL 223–268 mm). Total known variation within parentheses (see Tables 49, 50).

Dorsal fins XII–XIII, 1, 25–27 (XII–XIII, 1, 25–27); anal fin II, 21–23 (II, 21–24). Lateral line scales 129–141 (129–147) (usually 134–139). TR. 13–17 above, 16–20 below, 8–10 scales between the L. lat. and spinous dorsal origin. Cheek scales in 6–8 rows, the anterior scales cycloid, the posterior scales ctenoid.

Proportional dimensions as percent of SL: Greatest depth of body 14–18; head length 24–26; snout tip to ventral fin origin 26–29; snout tip to spinous dorsal fin origin 30–32; snout tip to second dorsal fin origin 49–52; snout tip to anal fin origin 57–60; least depth of caudal peduncle 5–6.

Proportional dimensions as percent of head: Length of snout 40–45; horizontal diameter of eye 17–21; least width of interorbital 13–16.

VERTEBRAE: 20–23 abdominal, 5–7 modified, 14–18 caudal; 20–23 + 21–23, total 42–44 (Table 51).

COLOUR IN ALCOHOL: Pale golden-brown, greyish-brown, or dark olive-green above; whitish, pale brown or silvery below with reflections of mauve, blue and green when fresh; back and upper sides with oblique rows of small round dark brown to rusty-brown spots, lower sides with open-spaced rather scattered round dark spots; belly white, without spots; dorsal fins uniform dark greenish-brown to light brown sometimes spotted with darker brown; anal fin, pectorals and ventrals pale brown to hyaline; caudal greenish to brownish, finely dusted with brown.

SWIMBLADDER: Very elongate with a single slender tapering posterior extension; two anterolateral extensions or horns project anteriorly; anterior part of the swimbladder is bound to the abdominal cavity by short collagen fibres; no duct-like process to the urogenital aperture is present. Cuvier (1829) states incorrectly that the rear of the swimbladder is forked.

GEOGRAPHIC VARIATION

No geographic variation was encountered. Sandars (1945, p. 107) found that *S. punctata* was host to two species of monogenetic parasites, *Microcotyle parasillaginae* and *M. sillaginae* and stated 'Although the two parasites are very closely related, they are certainly different species, but whereas *M. sillaginae* occurs only on fish from Victorian waters, *M. parasillaginae* is from fish from Western Australian waters'. The distribution of both parasites may be of value in delimiting two populations of *S. punctata* for closer study.

DISTRIBUTION

Jurien Bay, Western Australia southwards along the southern coast of Western Australia, South Australia and Victoria. Ogilby (1893, p. 99) records this species as occasionally reaching as far north as Port Jackson, N.S.W.

BIOLOGY

Juveniles are common in tidal estuaries and creeks, particularly those which flow into semi-enclosed bays and coastal 'lakes'. The juveniles appear to be most abundant on *Zostera* and *Posidonia* seaweed banks in shallow sheltered areas, moving out into the deeper water of the bays at a size of about 10 cm. Large catches of small fish of 10–20 cm are made in the sheltered areas of large bays, especially during the summer months, the larger fish although present throughout the bay, are concentrated in deeper water of 1 to 10 fathoms, generally in sand gutters or adjacent to banks. The largest adults observed are normally solitary fish in deeper water of 7 to 10 fathoms where they are associated with broken bottom, weedbanks or sand gutters. The offshore range of the species is not known; adult fish are taken along the coastal beaches and may enter estuaries in considerable numbers during March in Western Australia. Adult females with developed ovaries are rarely netted in shallow water but have been captured by spearfishermen in 3 to 5 fathoms in coastal bays and offshore waters in south-western Western Australia.

Maximum weight attained is about 10 lbs. Scott (1962) reports that this fish can atain a length in excess of 70 cm. One 9 lb. fish was taken by spear at Triggs Island, Western Australia.

Important commercial fisheries are developed in St. Vincent and Spencer Gulfs, at Kangaroo Island, and the west coast bays to Ceduna, South Australia. Smaller fisheries occur in Victoria, and at Albany and Bunbury, Western Australia.

Genus **Sillaginopsis** Gill

Sillaginopsis Gill, 1861, p. 505, type by original designation. *Sillago domina* Cuvier, 1829 (= *Cheilodipterus panijus* Hamilton — Buchanan, 1822).

Sillaginichthys Bleeker, 1874, p. 63, type by original designation, *Sillago domina* Cuvier, 1829.

TABLE 49: FREQUENCY DISTRIBUTIONS OF DORSAL AND ANAL FIN RAYS OF *SILLAGINODES PUNCTATA*

Dorsal rays	25	25	25	26	26	26	27	27	27
Anal rays	21	22	23	21	22	23	22	23	24
Western Australia	4	5	–	1	25	6	6	3	–
South Australia	5	16	3	3	62	14	–	2	1
Victoria	–	3	1	–	12	4	1	2	–

TABLE 50: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGINODES PUNCTATA*

Lateral line scales	128 129	130 131	132 133	134 135	136 137	138 139	140 141	142 143	144 145	146 147
Western Australia	1	3	–	6	8	5	3	–	–	–
South Australia	1	6	6	8	14	7	2	3	2	–
Victoria	–	–	1	2	–	1	1	–	1	2

TABLE 51: VERTEBRAE OF *SILLAGINODES PUNCTATA*

Abdominal	20	21	21	21	21	21	21	21	21	22	22	22	22	22	22	23
Precaudal	6	5	5	5	6	6	7	7	7	5	5	6	6	7	7	6
Caudal	17	16	17	18	16	17	14	15	16	16	17	15	16	14	15	15
Western Australia	–	–	–	–	3	1	–	3	2	2	–	2	11	1	1	1
South Australia	1	–	2	2	4	–	1	2	1	5	3	4	1	–	2	–
Victoria	–	1	–	–	1	3	–	1	2	2	3	5	9	3	–	–

DIAGNOSIS

Head much depressed; eyes small and partly covered by the constricted orbits; mouth small with the lower jaw shorter than the upper; teeth villiform, in bands on jaws and vomer, the outer row of teeth in the jaws slightly enlarged, with the two anterior-most teeth in the upper jaw larger than the remainder. Scales small, the lateral line with 84 to 90 scales. Dorsal fins with 10 spines, the second filamentous, and 25 to 27 rays; anal fin with 2 spines and 24 to 27 rays. Branchiostegal rays 5 or 6. Swimbladder absent or vestigial. Vertebrae 15 + 27 = 42. One species.

Sillaginopsis panijus (Hamilton-Buchanan)

Gangetic or Flathead Whiting
(Figs. 5D, 13Y–Z, 14R, 16)

Cheilodipterus panijus (Hamilton-Buchanan. 1822, pp. 57, 367 (Ganges estuaries). Day, 1876, p. 315.

Sillago domina Cuvier, *in* Cuvier and Valenciennes, 1829, p. 415, pl. 69 (Pondicherry). Swainson, 1838, p. 205. Cantor, 1850, p. 1003. Bleeker, 1853, p. 34; 1859, p. 167. Günther, 1860, p. 246. Day, 1869, p. 299; 1876, p. 315; 1878, p. 264, pl. 58, fig. 3; 1888, p. 791. Lloyd 1907, p. 228. Mookerjee, Ganguly and Mazumdar, 1946, p. 564.

Sillaginopsis domina, Gill, 1861, p. 505. Fowler, 1930, p. 654.

Sillaginopsis panijus, Fowler, 1933, pp. 432-3. Palekar and Bal, 1955, p. 128. Misra, 1962, pp. 231–2. Dutt and Sujatha, 1980, pp. 371–374.

Sillago panijus, Day, 1876, p. 315 footnote. Krishnayya, 1963, pp. 391–412.

MATERIAL EXAMINED

TYPES: *Cheilodipterus panijus* Hamilton Buchanan. Location of holotype unknown.

Sillago domina Cuvier. Holotype dried skin registered A5450 in the Museum National D'Histoire Naturelle, Paris. No vertebrae count is possible.

OTHER MATERIAL: WAM P15370–9 (15) Bay of Bengal. SOSC 4 (5), Lat. 21°52′N, Long. 91°36′E.

DIAGNOSIS

Dorsal fins X, 1, 26–27; anal fin II, 24–26; lateral line scales 84–88; total vertebrae 42; head greatly depressed, eye very small.

DESCRIPTION

(Based on 10 examples from the Bay of Bengal SL 95–293 mm).

Dorsal fins, X, 1, 26–27; anal fin II, 24–26. Lateral line scales 84–88. TR. 6 above, 13 below, 6–7 scales between L. lat. and spinous dorsal origin. Cheek scales in 3–4 rows, eyeloid and ctenoid (mostly ctenoid, but some cycloid scales on all examples).

Proportional dimensions as percent of SL (modal frequency within parentheses). Greatest depth of body 14–16 (14–15); head length 28–30 (29); snout tip to ventral fin origin 30–33 (31); snout tip to spinous dorsal fin origin 31–34 (33); snout tip to second dorsal fin origin 45–47 (47); snout tip to anal fin origin 51–54 (54); least depth of caudal peduncle 6.

Proportional dimensions as percent of head: Length of snout 40–43 (43); horizontal diameter of eye 3–11 (7), a specimen of 95 mm was 10.7, all others were less than 7.4; least width of interorbital 14–18 (18).

VERTEBRAE: 15 abdominal, 27 caudal, total 42.

SWIMBLADDER: No swimbladder was observed, although Cuvier (1929) states 'The air bladder appears like a silvery dot, the size of a pin-head, suspended above the base of the stomach in a transparent and very thin membrane'. No accessory duct.

COLOUR IN ALCOHOL: Body light brown above, paler to whitish below. Fins pale brownish with a light dusting of fine black spots.

DISTRIBUTION

Pondicherry northwards along the Coromandel coast, Ganges delta, Burma, southwards to Malaysia and rarely to the Indonesian Archipelago.

BIOLOGY

Sillaginopsis panijus attains a length of 44 cm, and is a commercially important fish captured by nets and longlines in the Hooghly and Ganges delta. Krishnayya (1963) studied the otoliths and size-age compositions of the commercial catches from the Hooghly estuary and arrived at the conclusion that *S. panijus* probably spawns twice a year during the months November to February and August to September and the juveniles migrate towards the upper reaches during March and April and during December where they remain for two to three months. Sexual maturity is attained at a length of about 120 mm. Cuvier (1829) found numerous small fishes and crustacea in the gut contents Mookerjee, Ganguly and Mazumdar (1946) recorded the gut contents of 10 specimens and found them to be feeding primarily on crustacea, algae, and fish.

REMARKS

The small eyes, flattened head, filamentous second dorsal spine, and the lack of a swimbladder suggests demersal adaptation to muddy water conditions. Fowler (1933) placed this species in a separate subfamily Sillaginopsinae, a procedure not adopted in this revision.

TABLE 52: FREQUENCY DISTRIBUTION OF DORSAL AND ANAL FIN RAYS OF *SILLAGINOPSIS PANIJUS*

Dorsal rays	26	26	26	27	27
Anal rays	24	25	26	25	26
Bay of Bengal	1	9	1	1	3

TABLE 53: FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF *SILLAGINOPSIS PANIJUS*

Lateral line scales	84	85	86	87	88
Bay of Bengal	5	1	4	1	2

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1849a. Bijdrage tot de kennis der Percoiden van den Malayo-Molukschen Archipel, met beschrijving van 22 nieuwe soorten. *Verh. batav. Genoot. Kunst. Wet.* **22**: 1–64.

1849b. Bijdrage tot de kennis der ichthyologische fauna van het eiland Madura, met beschrijving van eenige nieuwe species. *Verh. batav. Genoot. Kunst. Wet.* **22**: 1–16.

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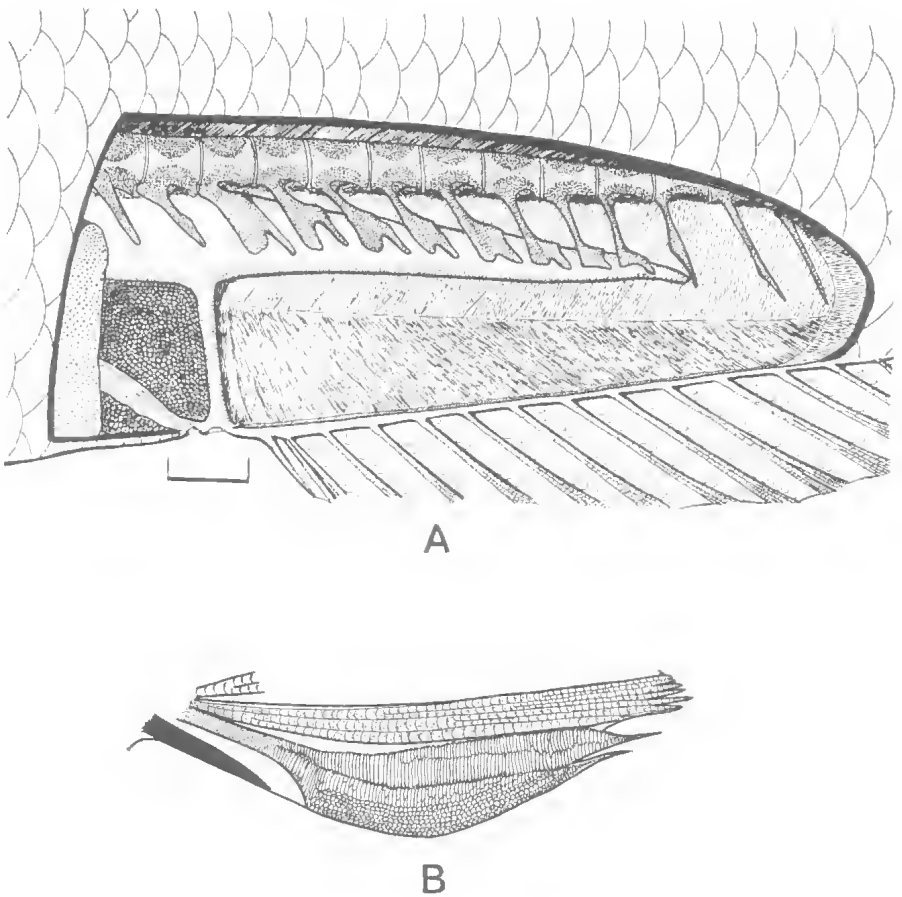

FIG. 1. **A.** *Sillago* (*Parasillago*) *ciliata* showing modified caudal vertebrae overlying the posterior extension of the swimbladder and the tubular duct-like process arising from the ventral surface of the swimbladder. **B.** Modified ventral fin of *Sillago* (*Sillaginopodys*) *chondropus*.

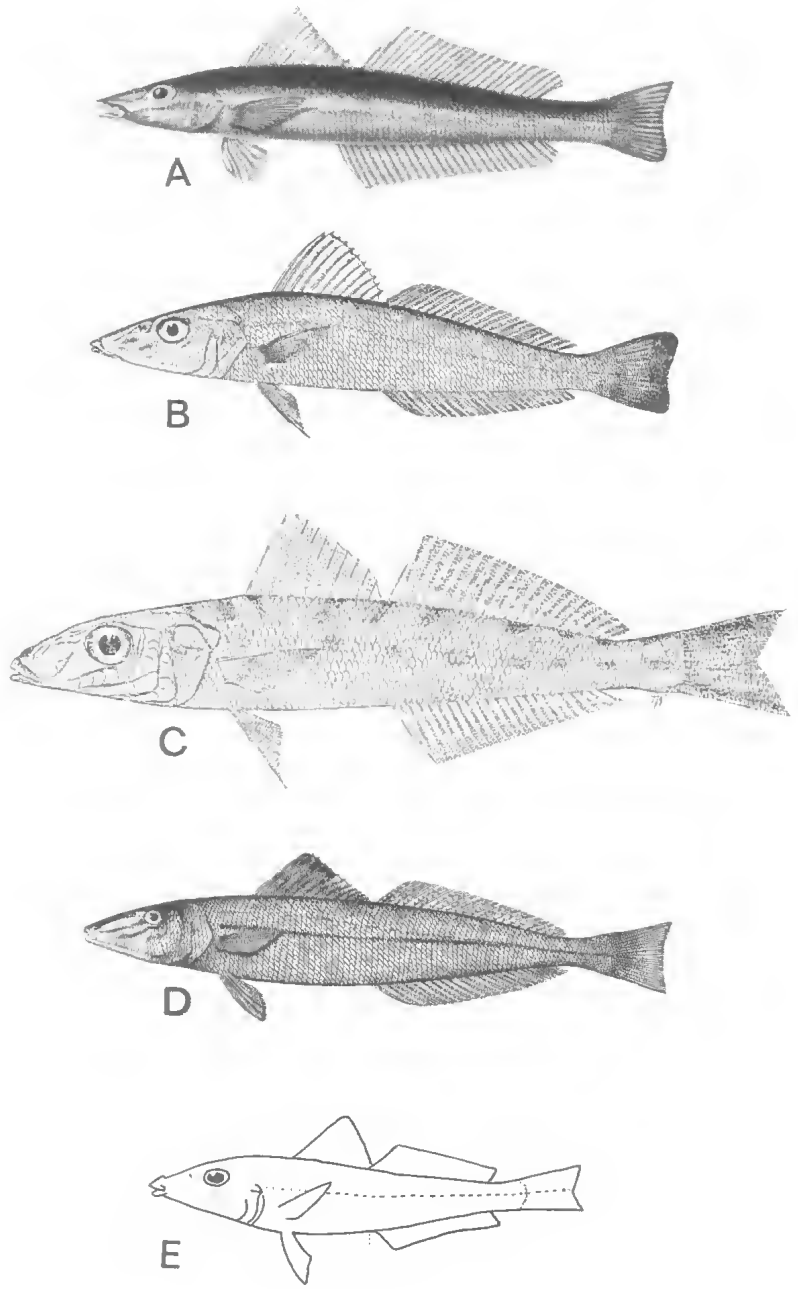

FIG. 2. **A.** *Sillago* (*Sillaginopodys*) *chondropus* Bleeker (from Bleeker). **B.** *Sillago* (*Sillago*) *sihama* (Forskal). **C.** *Sillago* (*Sillago*) *intermedius* Wongratana (from Wongratana). **D.** *Sillago* (*Sillago*) *parvisquamis* Gill (from Tanaka). **E.** *Sillago* (? *Sillago*) *megacephalus* Lin (from Lin).

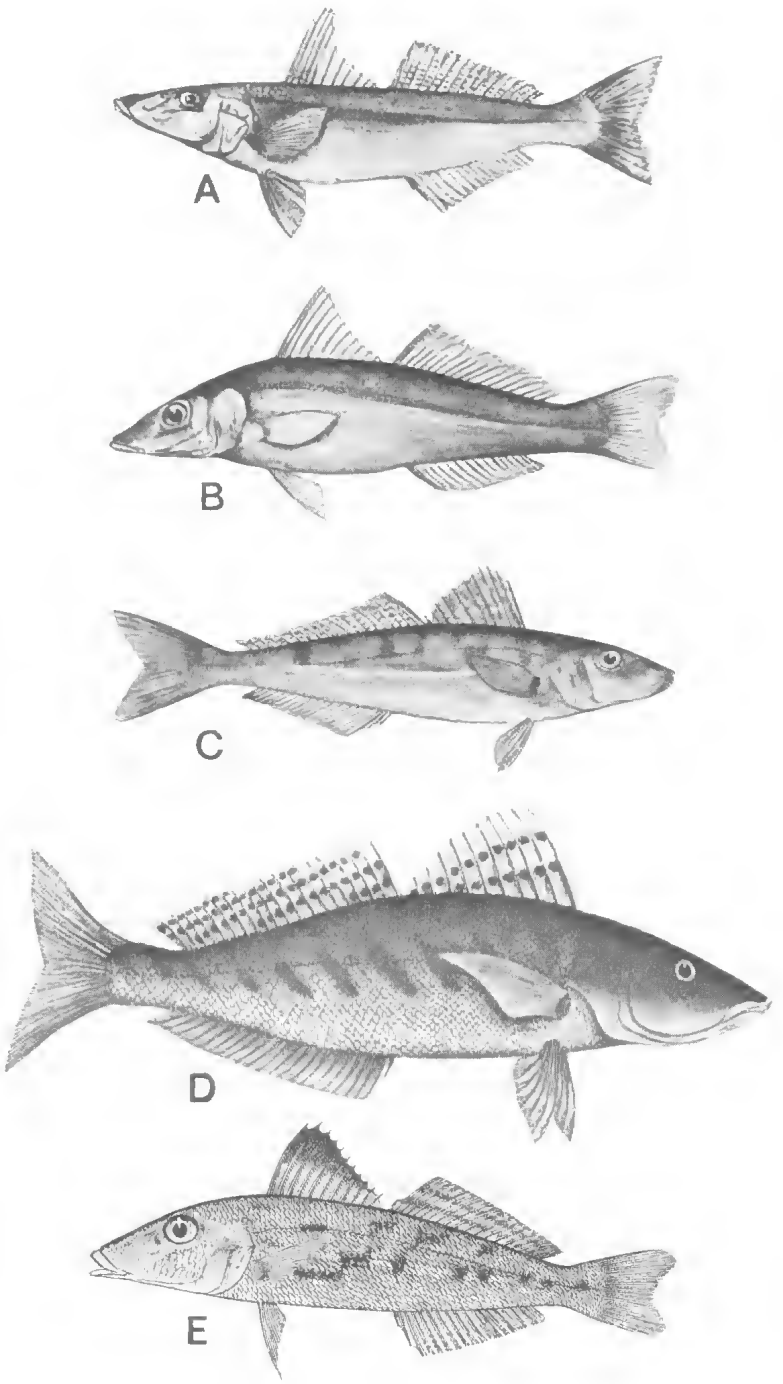

FIG. 3. **A.** *Sillago* (*Parasillago*) *ciliata* Cuvier (from Grant). **B.** *Sillago* (*Parasillago*) *analis* Whitley (from Grant). **C.** *Sillago* (*Parasillago*) *maculata maculata* Quoy and Gaimard (from Grant). **D.** *Sillago* (*Parasillago*) *maculata burrus* Richardson (from Richardson). **E.** *Sillago* (*Parasillago*) *maculata aeolus* Jordan and Evermann (from Martin and Montalban).

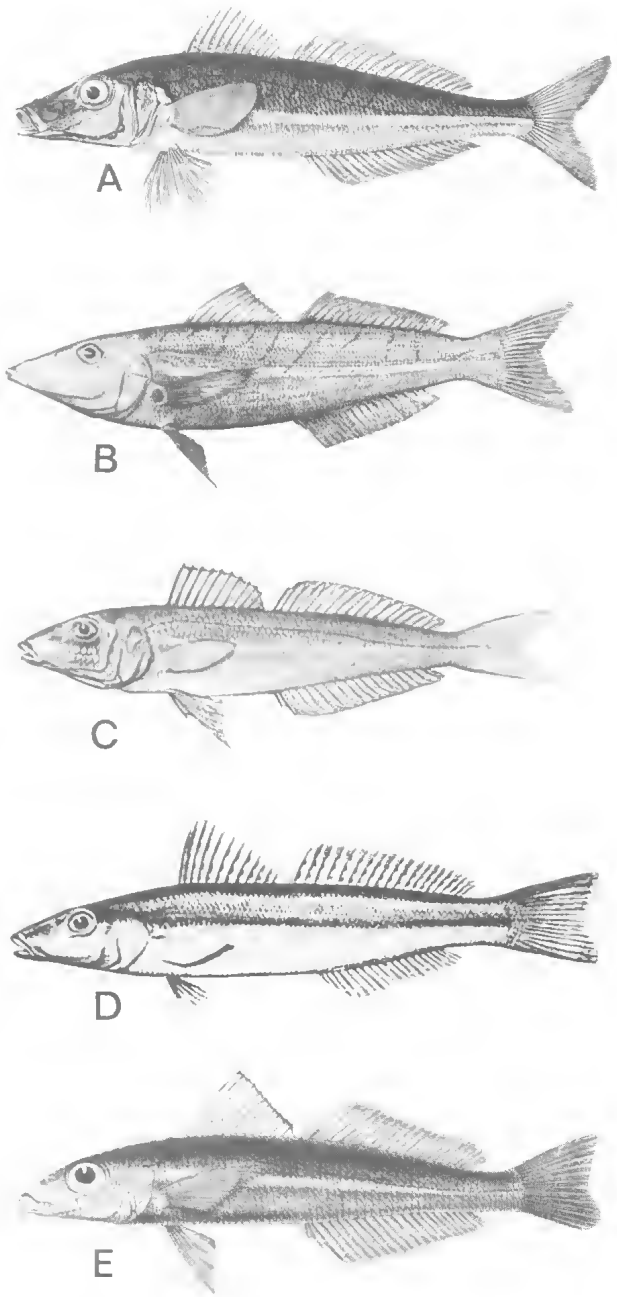

FIG. 4. **A.** *Sillago*(*Parasillago*) *bassensis bassensis* Cuvier (modified from Quoy and Gaimard) **B.** *Sillago* (*Parasillago*) *vittata* sp. nov. **C.** *Sillago* (*Parasillago*) *robusta* Stead (from Grant). **D.** *Sillago* (*Parasillago*) *schomburgkii* Peters (from Scott). **E.** *Sillago* (*Parasillago*) *macrolepis* Bleeker (from Bleeker).

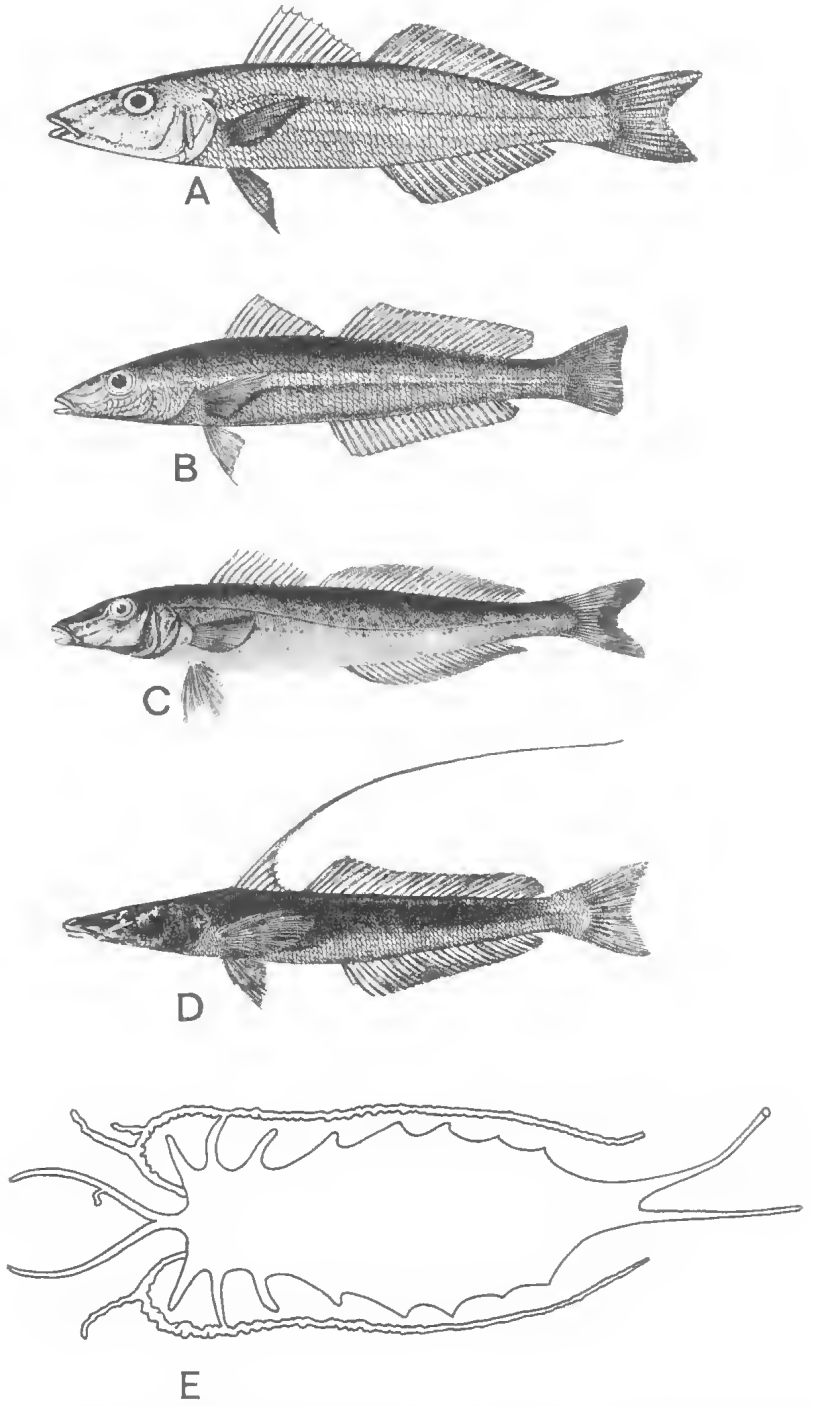

FIG. 5. **A.** *Sillago argentifasciata* Martin and Montalban (from Martin and Montalban). **B.** *Sillago* (*Parasillago*) *japonica* (from Bleeker). **C.** *Sillaginodes punctata* (Cuvier) (from Quoy and Gaimard). **D.** *Sillaginopsis panijus* (Hamilton-Buchanan) (from Day). **E.** swimbladder of *Sillago indica*.

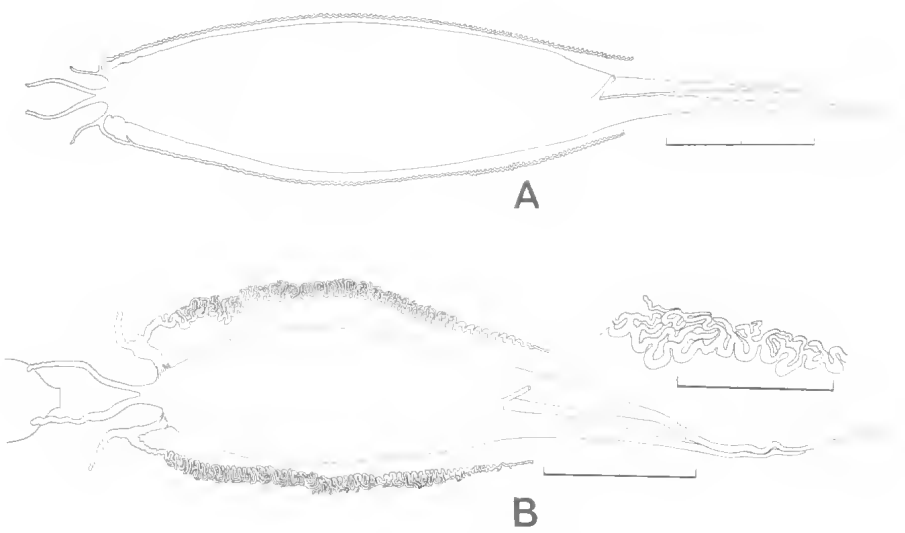

FIG. 6. Variation in the swimbladder of *Sillago sihama*. **A.** Red Sea. **B.** Queensland.

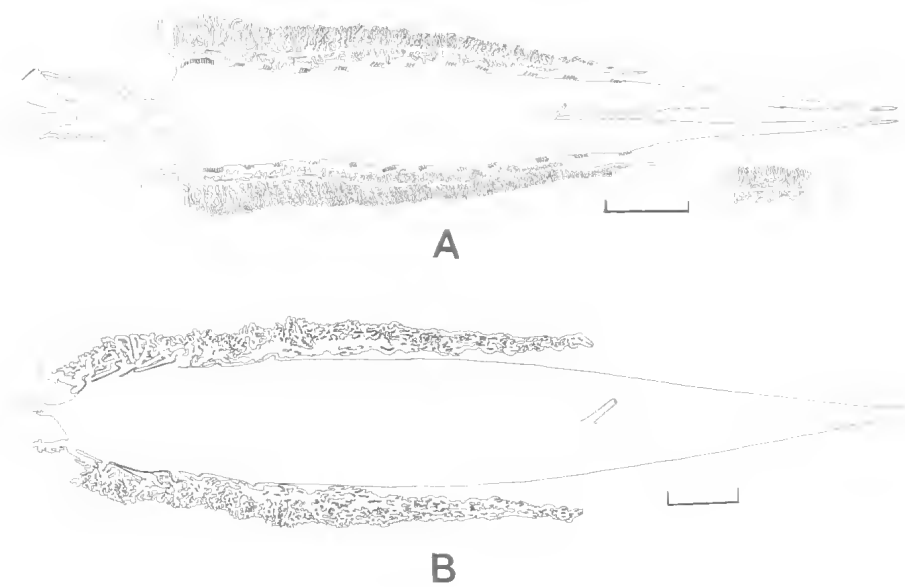

FIG. 7. Swimbladders of **A.** *Sillago parvisquamis*. **B.** *Sillago maculata maculata*.

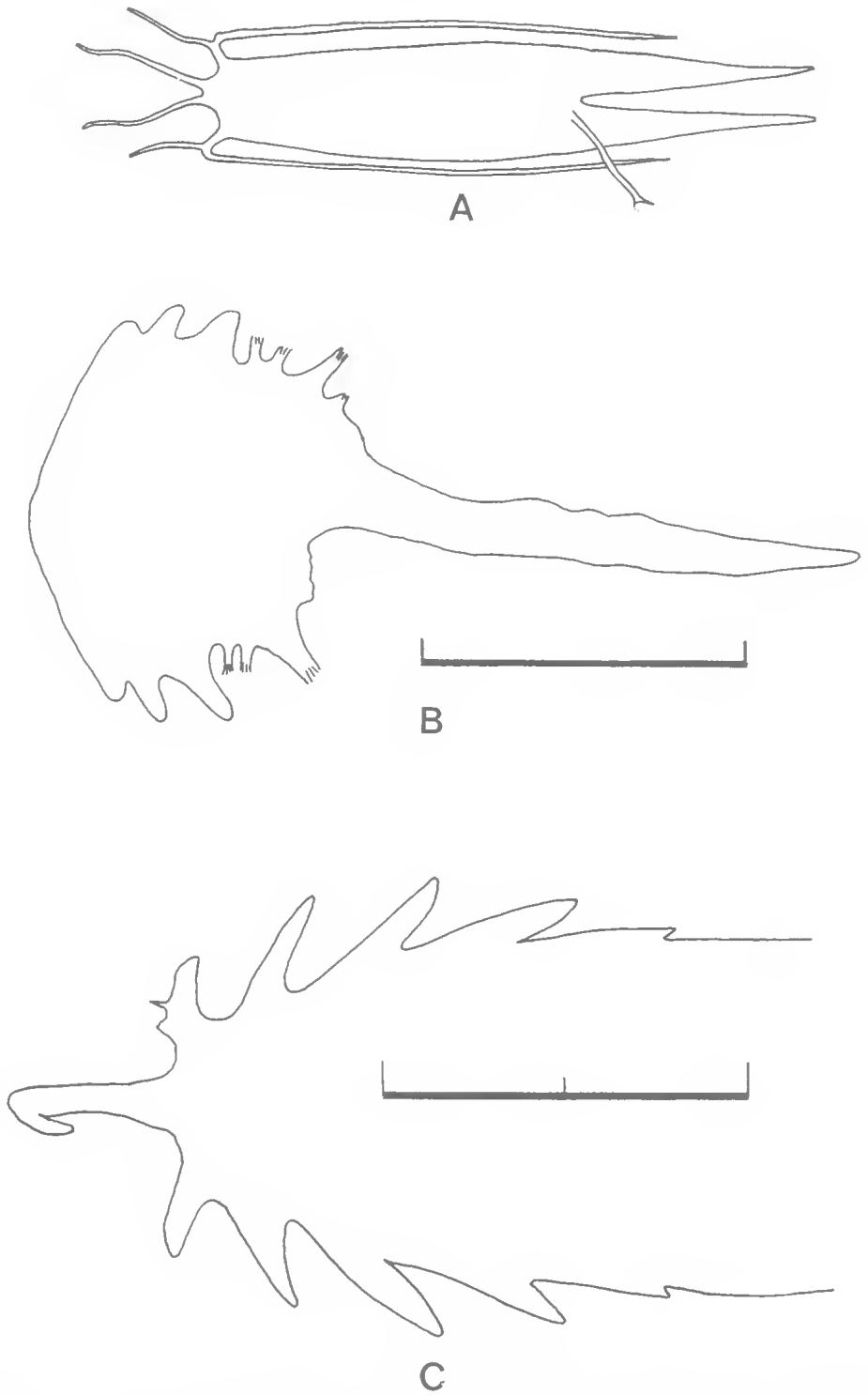

FIG. 8. Swimbladders of **A.** *Sillago intermedius* (after Wongratana). **B.** *Sillago chondropus.* **C** *Sillago ingenuua* (anterior half only).

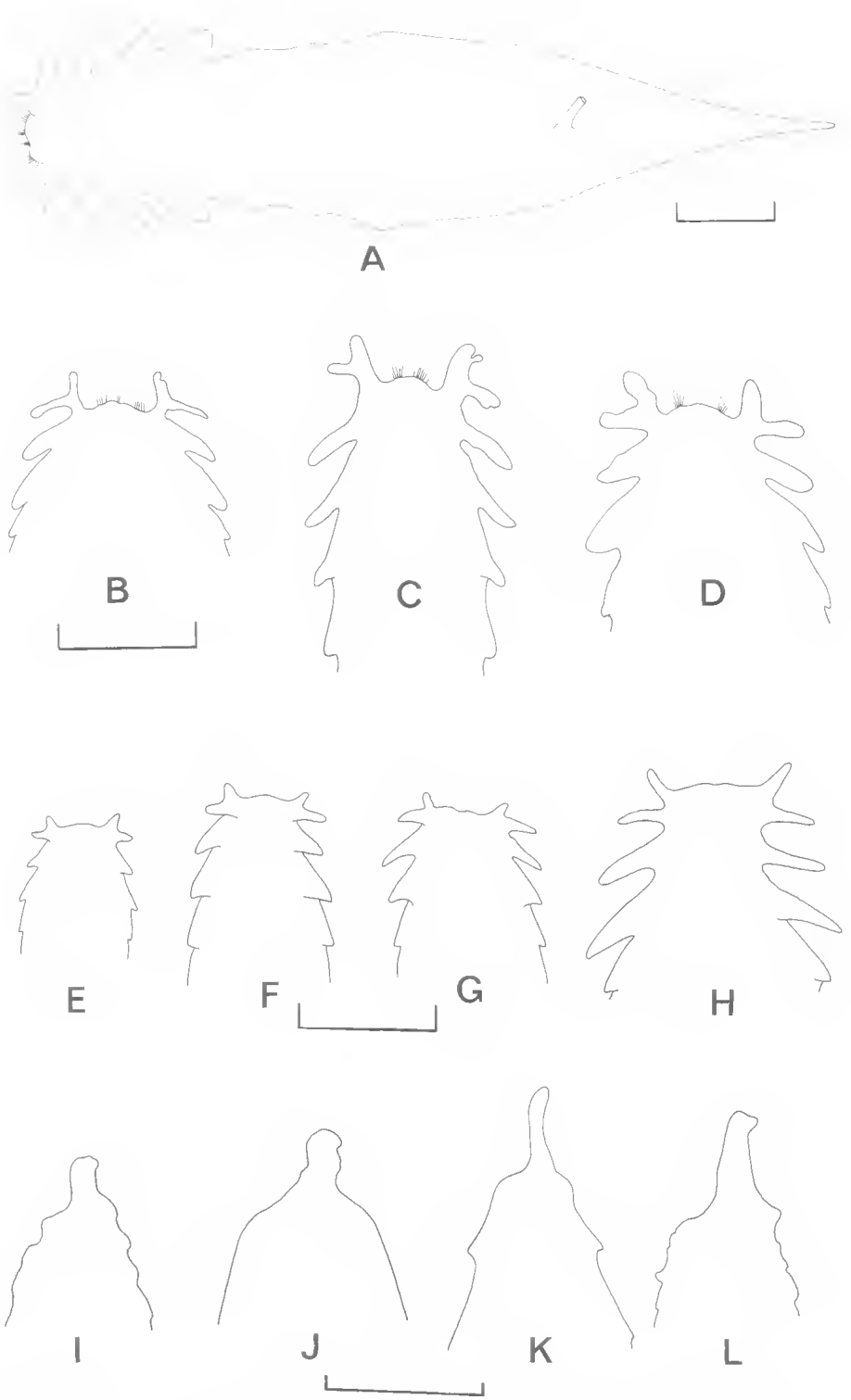

FIG. 9. Swimbladders of **A–D.** *Sillago analis.* **E–H.** *Sillago ciliata.* **I–L.** *Sillago bassensis flindersi.*

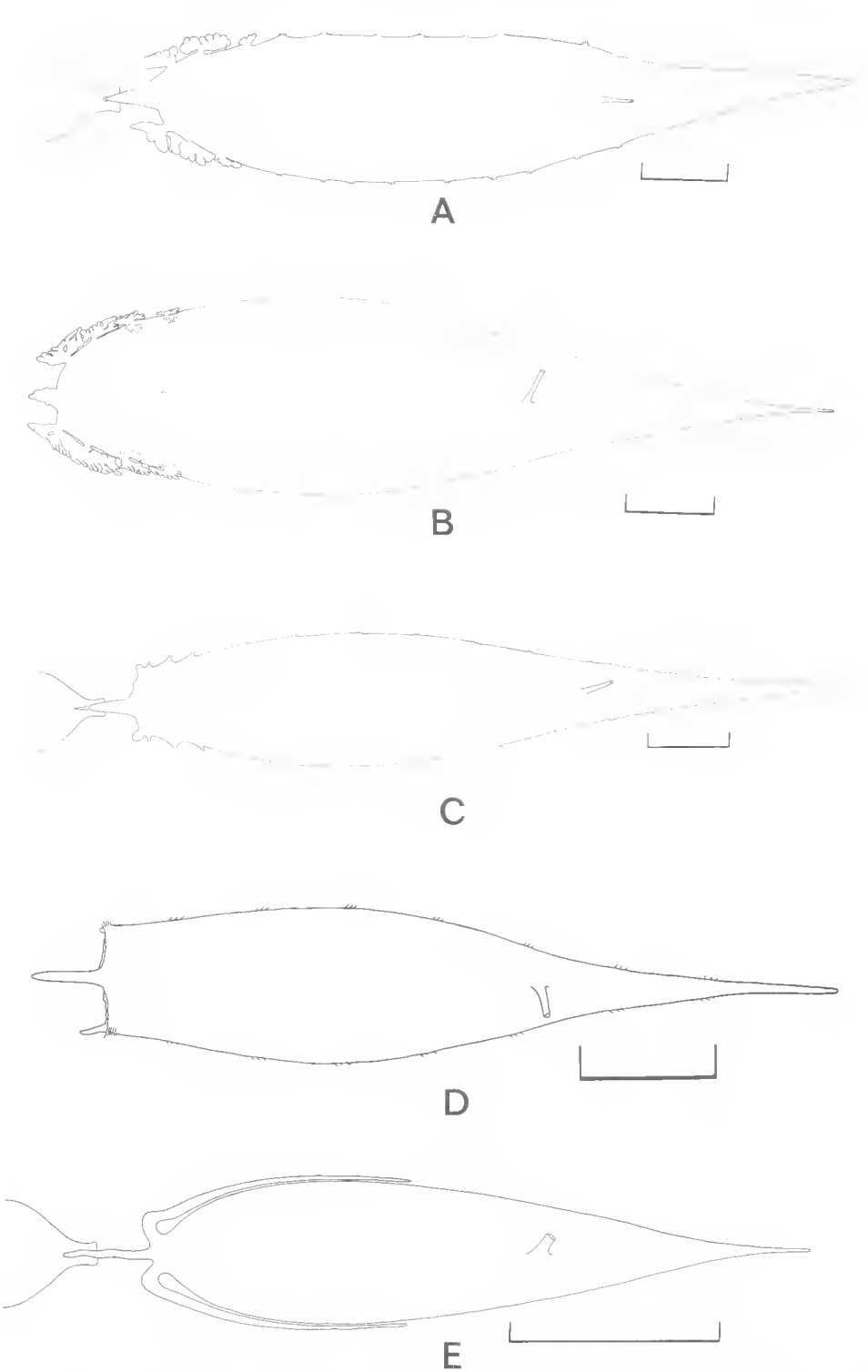

FIG. 10. Swimbladders of **A.** *Sillago maculata aeolus*. **B.** *Sillago maculata burrus*. **C.** *Sillago vittata*. **D.** *Sillago lutea*. **E.** *Sillago asiatica*.

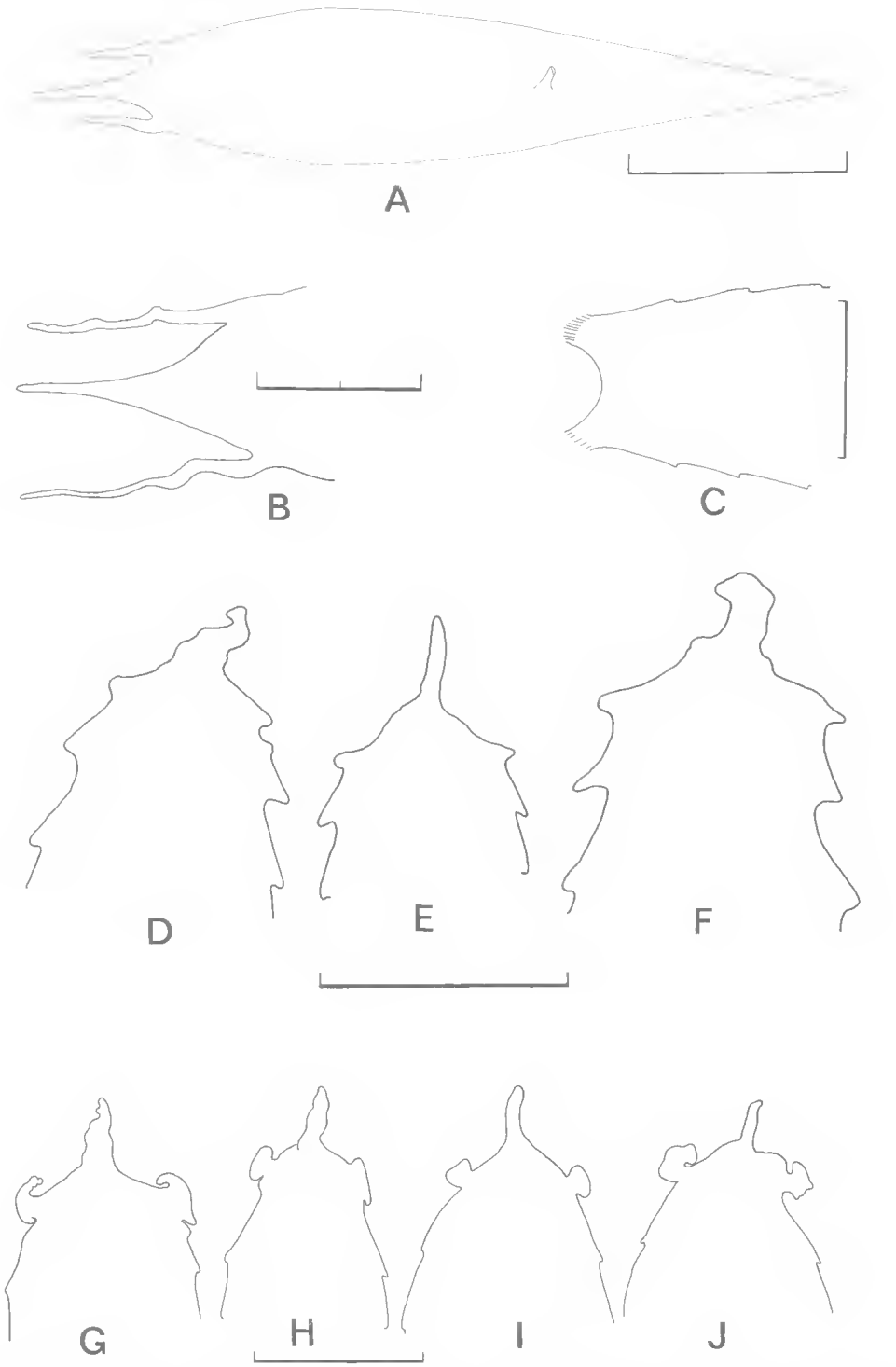

FIG. 11. Swimbladders of **A–B.** *Sillago japonica.* **C.** *Sillago schomburgkii.* **D–F.** *Sillago robusta* (Western Australia). **G–J.** *Sillago robusta* (Queensland).

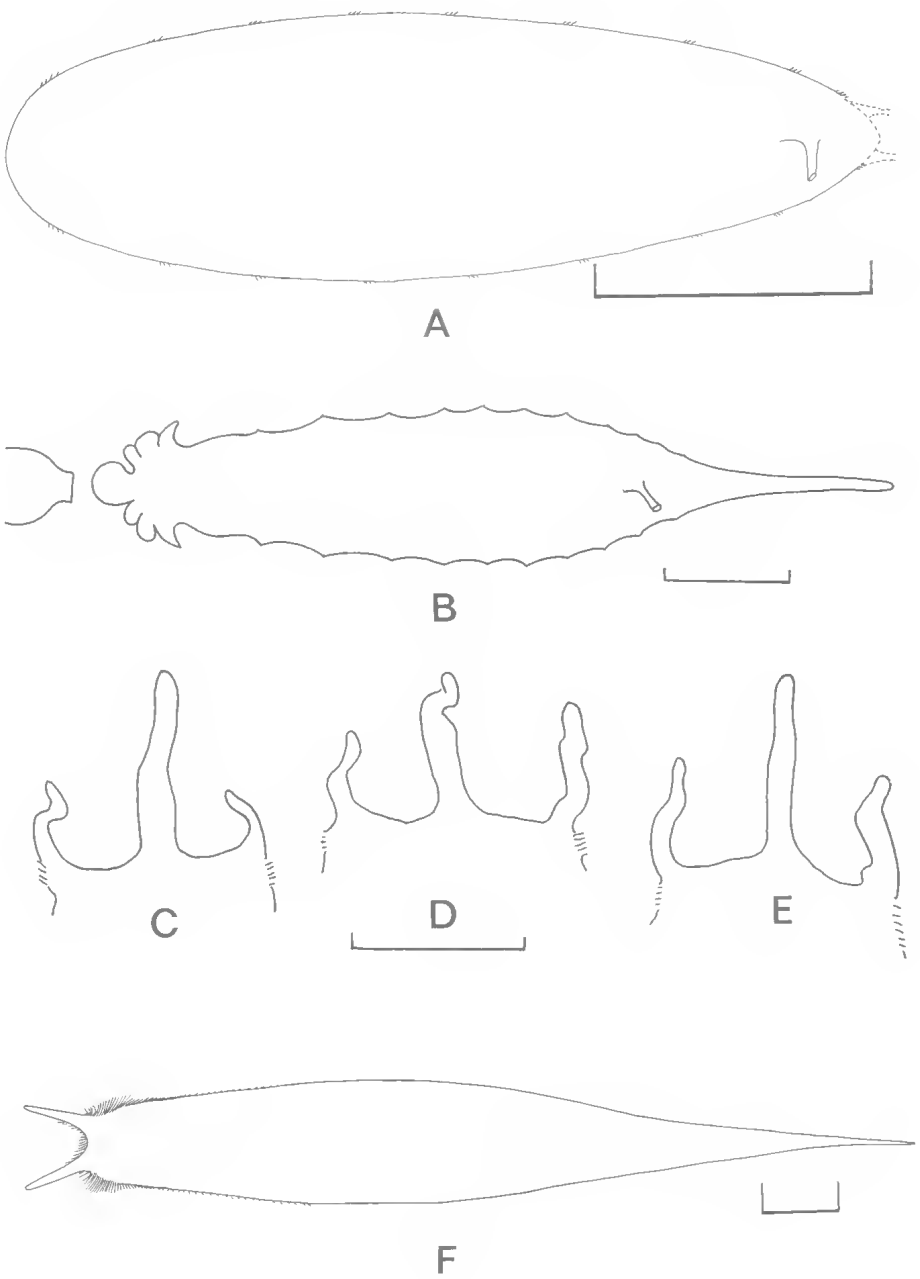

FIG. 12. Swimbladders of **A.** *Sillago attenuata*. **B.** *Sillago vincenti*. **C–E.** Variation in anterior part of *Sillago lutea*. **F** *Sillaginodes punctata*.

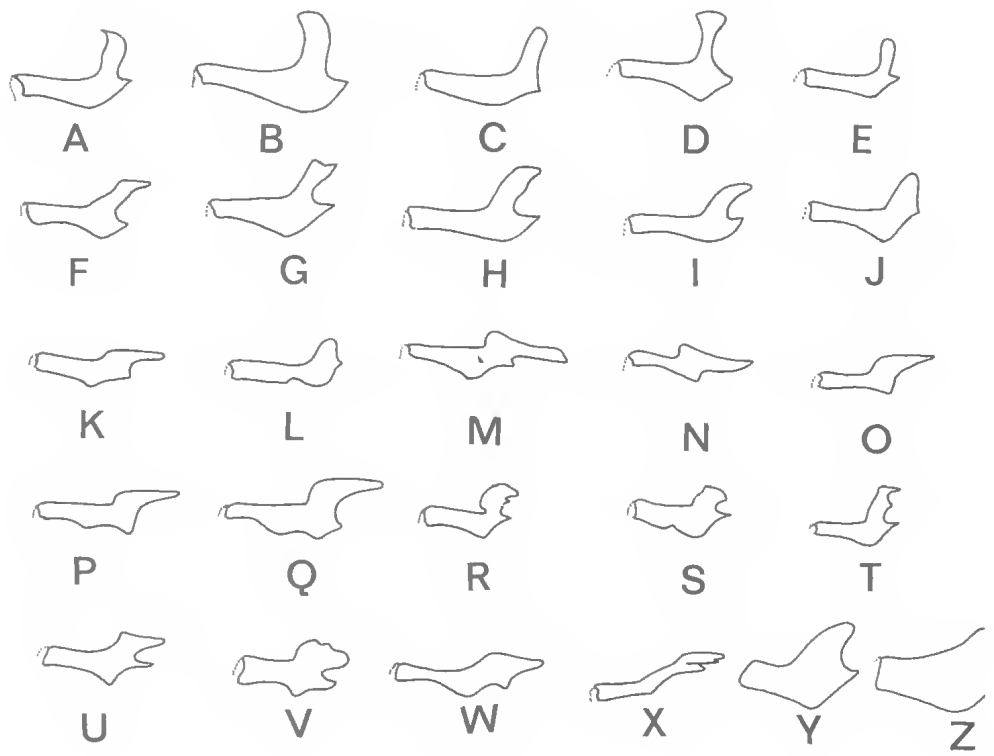

FIG. 13. Dorsal surface (suborbital shelf) of the third suborbital bone (right side) of **A.** *Sillago sihama.* **B.** *Sillago parvisquamis.* **C.** *Sillago attenuata.* **D.** *Sillago boutani.* **E.** *Sillago vincenti.* **F,G.** *Sillago japonica.* **H,I.** *Sillago lutea.* **J.** *Sillago macrolepis.* **K.** *Sillago ciliata.* **L.** *Sillago analis.* **M–O.** *Sillago vittata.* **P.** *Sillago maculata maculata.* **Q.** *Sillago maculata aeolus.* **R,S.** *Sillago robusta* (New South Wales). **T.** *Sillago robusta* (Shark Bay, W.A.). **U,V.** *Sillago bassensis bassensis.* **W.** *Sillago schomburgkii.* **X.** *Sillaginodes punctata.* **Y,Z.** *Sillaginopsis panijus.*

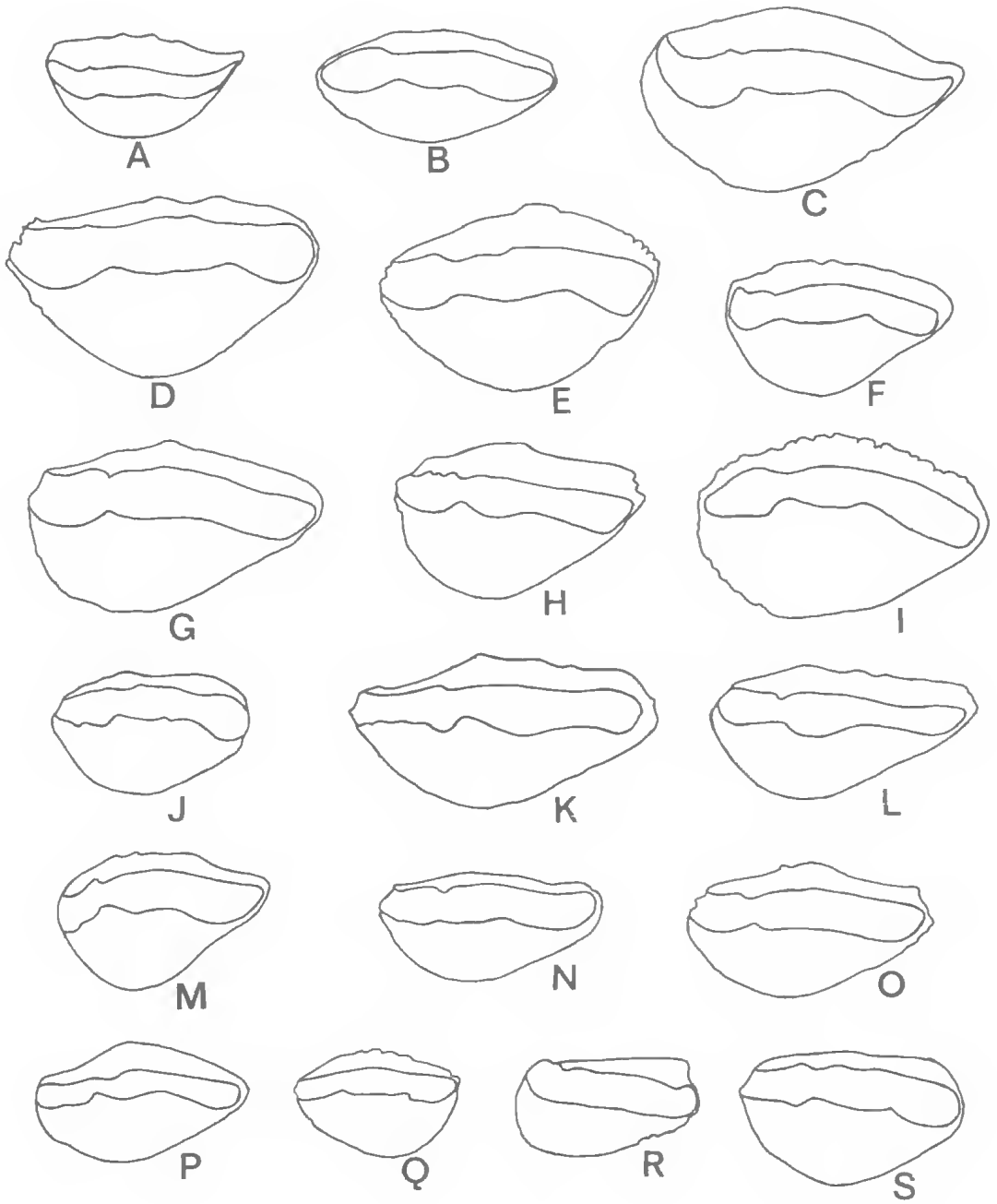

FIG. 14. Otoliths (right side) of **A** *Sillago sihama,* Madras, India. **B.** *Sillago parvisquamis,* Taiwan. **C.** *Sillago vincenti,* India. **D,E.** *Sillago ciliata,* Sydney. **F.** *Sillago analis,* Shark Bay. **G.** *Sillago maculata maculata,* New South Wales. **H.** *Sillago maculata burrus,* Shark Bay **I.** *Sillago maculata aeolus,* Singapore. **J.** *Sillago bassensis bassensis,* Western Australia. **K.** *Sillago bassensis flindersi,* New South Wales. **L.** *Sillago vittata,* Shark Bay. **M.** *Sillago robusta,* New South Wales. **N.** *Sillago robusta,* Western Australia. **O.** *Sillago schomburgkii,* Shark Bay. **P.** *Sillago ingenuua,* Thailand. **Q.** *Sillago japonica,* Tokyo. **R.** *Sillaginopsis panijus,* Bay of Bengal. **S.** *Sillaginodes punctata,* South Australia.

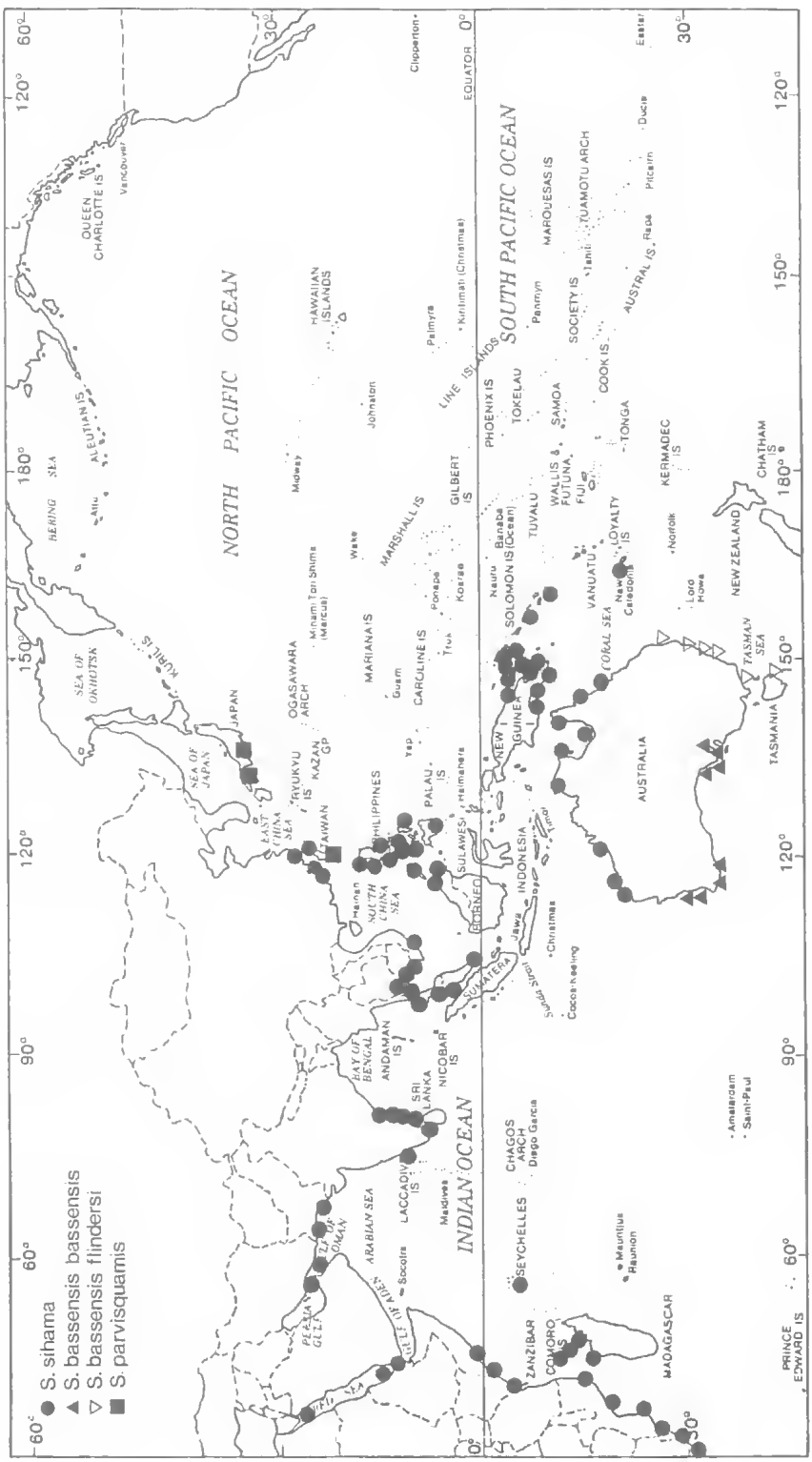

FIG. 15. Distributional records of *Sillago* species.

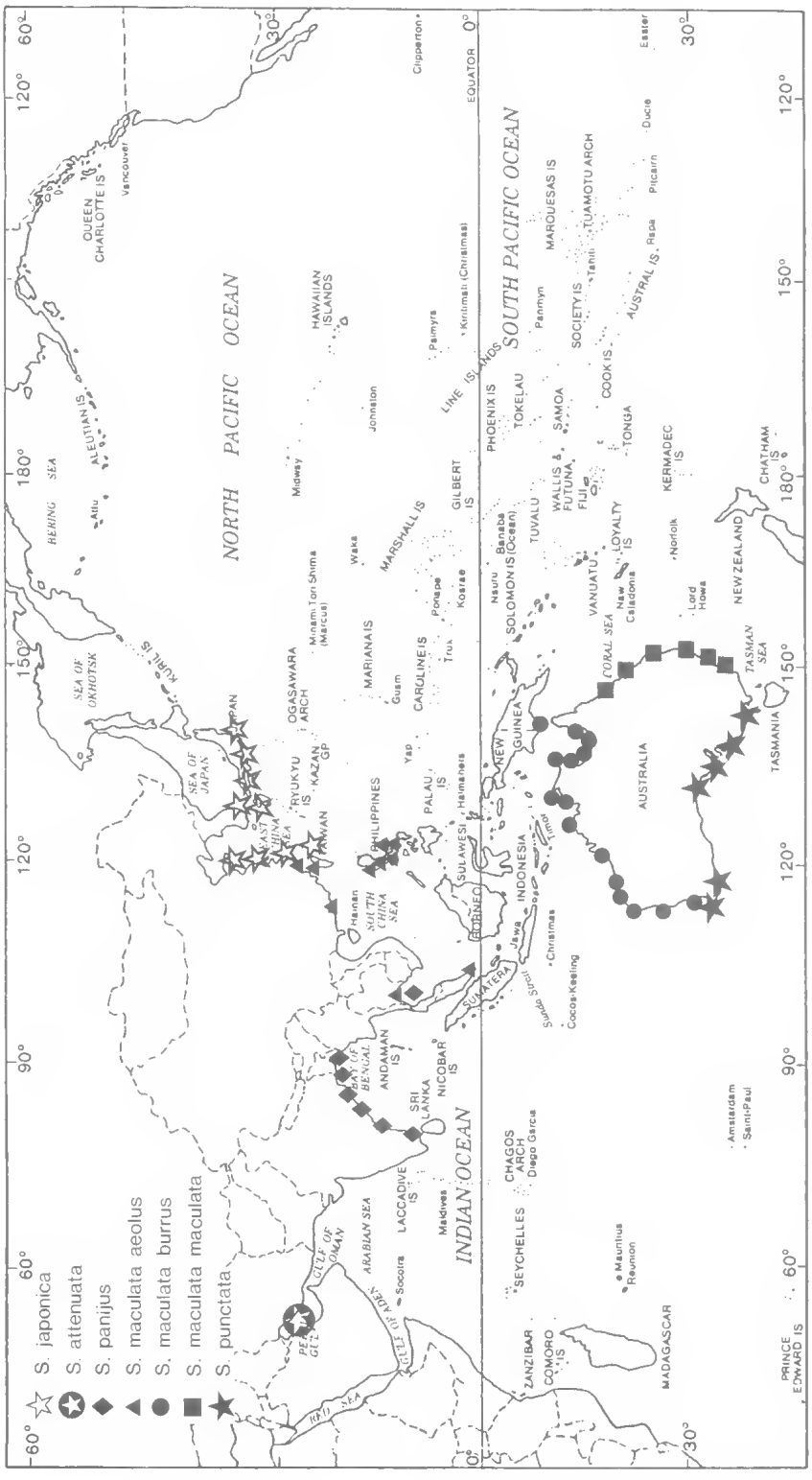

FIG. 16. Distributional records for *Sillago*, *Sillaginodes*, and *Sillaginopsis*.

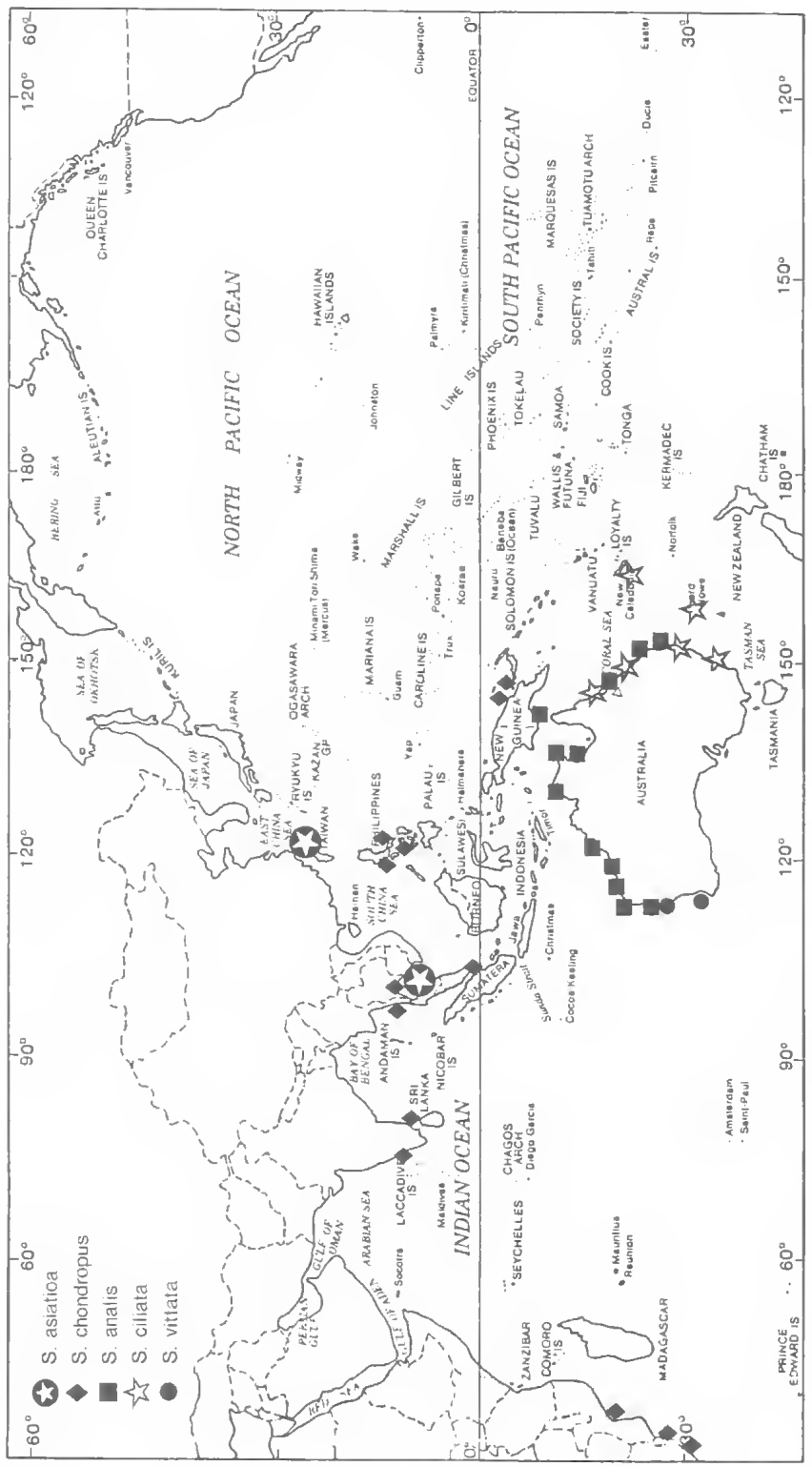

FIG. 17. Distributional records for *Sillago*, species.

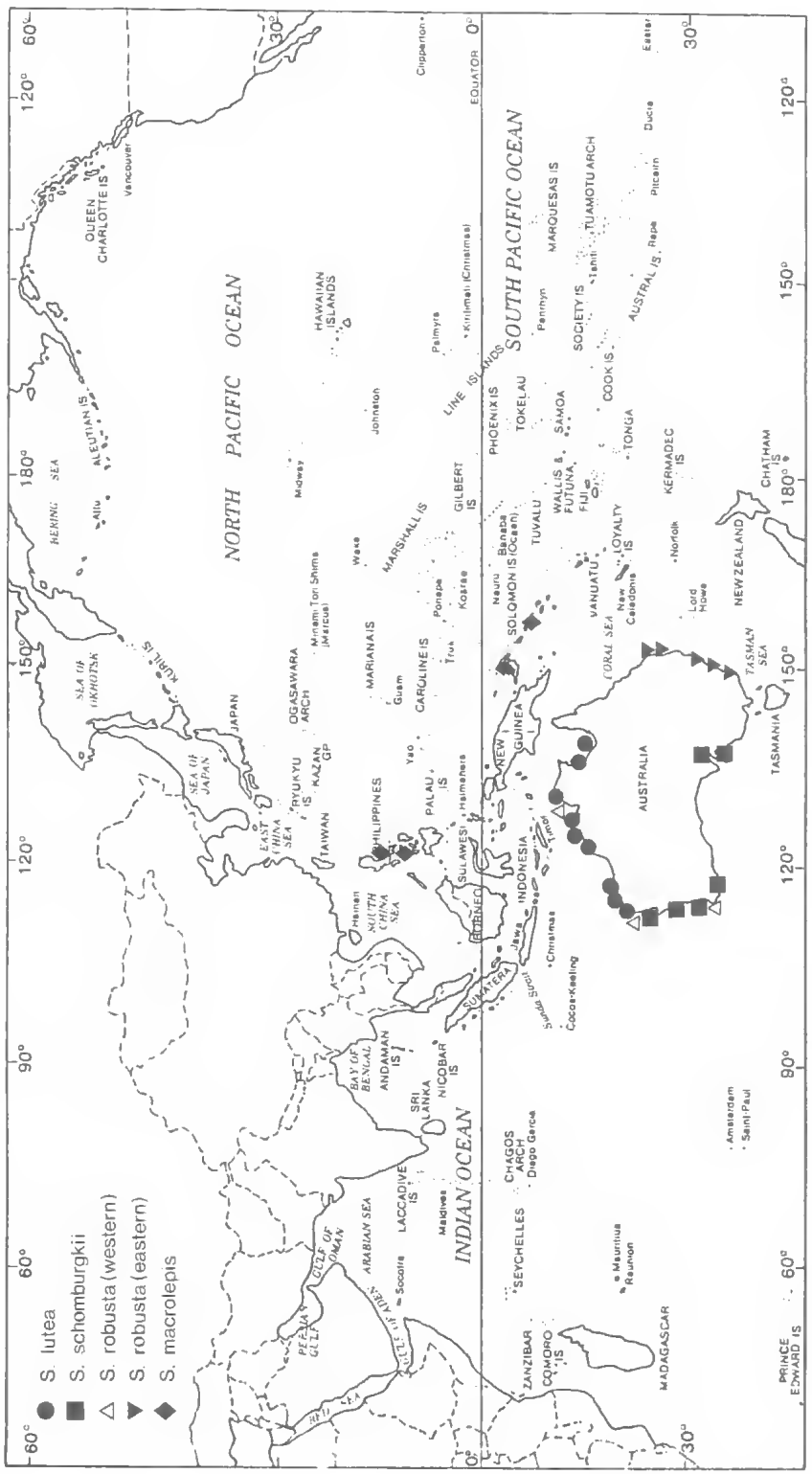

FIG. 18. Distributional records for *Sillago*, species.